

FOREST PROTECTION

THE SPRUCE BUDWORM

**WORKSHOP PROCEEDINGS
MAY 5-6, 1998
FREDERICTON, N.B.**

**SPONSORED BY THE PREMIER'S ROUND TABLE
ON ENVIRONMENT AND ECONOMY**





**PREMIER'S ROUND TABLE ON
ENVIRONMENT AND ECONOMY**

**LA TABLE RONDE DU PREMIER MINISTRE
SUR L'ENVIRONNEMENT ET L'ECONOMIE**

P.O. Box 6000 / C.P. 6000, Fredericton, N.-B. E3B 5H1

Hon. Roly MacIntyre, Co-Chair/Co-Président - (506) 453-3009

Dr. Louis LaPierre, Co-Chair/Co-Président - (506) 858-4152

Dr. David Besner, Executive Secretary/Secrétaire exécutif - (506) 453-3703

DEAR MEMBERS OF THE ROUND TABLE AND PARTICIPANTS:

I am pleased to forward you a copy of the Proceedings and the Summary Notes from the four break-out groups from the Budworm Protection workshop held in Fredericton on May 5-6, 1998.

The Premier's Round Table on Environment and Economy will prepare recommendations, which will be submitted to the Premier early in the new year.

I wish to thank you for your time and consideration.

Sincerely,

**Louis LaPierre, Ph.D.
Chair of the Forestry Sub-Committee**

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**FOREST PROTECTION AND THE SPRUCE BUDWORM
BUDWORM WORKSHOP**

MAY 5 - 6, 1998

1.0 WELCOME

Louis LaPierre: If any of you have not indicated whether you are staying for dinner tonight, we would appreciate you telling us during the day. And, if you change your mind, we would also appreciate you letting us know. I will remind you periodically throughout the day.

Well, good morning and welcome to the Budworm Workshop. My name is Louis LaPierre and I will chair the session today. With us this morning to start the conference, I would like to introduce Alan Graham, Minister of Natural Resources and Energy. Mr. Graham has kindly accepted to come and give us a few words of wisdom before we start our deliberations. I will now ask Mr. Graham to open the workshop with his welcoming words.

Alan Graham: Thank you Louis, and good morning ladies and gentlemen. Just after a leadership convention and a lot of long hours and late nights, a person maybe not be as bright as he should be. This reminds me of the story of the fellow who was guest-speaker at a function. Just before he went to get up he said to the fellow next to him, "I got a problem, my teeth have been bothering me, and I left them in my hotel room. I got to go back and get them". The fellow said "No problem, I got some here", and he reached in his pocket and said, "Try these". "No, he said, they are too loose". So he reached in his other pocket and he said, "Try these". "No, he said, they are too tight". So, he brought another pair out and said, "Try these". He said "gosh, they just fit well. Tell me, are you a dentist?" "No", he said, "I am an undertaker". So, sometimes I grab the wrong speech, but I do not really have a speech this morning.

First of all, I want to welcome everyone to what is a very important subject and a very important workshop. I think it is a very opportune time for everyone to be able to take part and to analyze the budworm situation when we are not in an epidemic and we are not in a crisis, but when we have time to plan things and plan them well.

I see around the room, there are people representing many different aspects of the industry. Whether it be the industry itself, whether it be environmental, whether it be labour and so on. I believe that it will make for a very healthy discussion today and a very healthy opportunity to air all of the subjects that need to be discussed. I just want to leave one thing in your mind or install one thing in your mind, which I am sure I do not have to, but I do want to. And, that is the most recent figures or the most recent polling that has been done with regard to the industry. It was just completed. I think it is fair to share the questions from the poll with all of you, because it shows the importance of what you are going to decide here today. It will show the importance of why you are here and why you are here showing your concerns.

The questions were polled out of 400 New Brunswickers across the province, split evenly 50% male, 50% female of all walks of life. The first question was: "In your opinion, what industry or area of economic activity contributes most to the New Brunswick economy today?" Mentioned were agriculture @ 3%; Call Centres @ 1%; computers and advanced technology @ 2%; fishery @ 6%; and forestry @ 51%. I believe the evidence is there that New Brunswickers realize that the forest industry is the most important. The next question which is most telling was: "How important do you believe each of the following industries are in terms of contribution to the overall New Brunswick economy?" Again, very important, the first industry mentioned was the forest industry, at 86%.

I think it is on everyone's mind that we do prudent management of our forest, prudent development of our industry, prudent acknowledgement and perseverance with regard to the environmental problems that can arise. That we put all that together.

I am sure that at the end of the day, even today, that all of us and all of you people will come out better learned, better understanding and better prepared for an epidemic, if it ever comes again. We are at a very good time to plan now. I congratulate Nelson Carter who works in our Department, who takes a very keen interest in this, that we start planning for something that maybe will never happen. But, you plan for forest fires, you plan for other crisis in the forest industry and it is only proper that we do that.

On behalf of the government, on behalf of my Department, and on behalf of myself, I welcome you. I hope that today's deliberations are full of knowledge and learning and sharing of ideas, and that at the end of the day, you can come out with a concern, with fulfilling some of the concerns that may or may not have been there before. But, you can fulfil some of the answers that are still out there as question marks. Thank you very much and good luck to you all.

2.0 INTRODUCTION TO THE WORKSHOP

Louis LaPierre: Thank you very much Mr. Graham for your kind thoughts. In welcoming you to the Budworm Workshop, I would like to stress the reason why we are here. I would also like to state the objectives that we would like to achieve.

First of all, the Premier's Round Table on Environment and Economy has spent some time over the past year or two evaluating forests, the New Brunswick forest, and various issues associated with it. The Premier's Round Table undertook a conference here last Fall. During this conference, people attending brought forward various subjects that were associated with the forest management in New Brunswick. At the top of the list, in most of the workshops, was the budworm problem. Following the results of the last workshop, the Premier's Round Table reviewed the documentation and identified five major issues from that. These five major issues will be part of a presentation to the Cabinet later on this Fall. They will be : the Budworm, Fire Protection Strategy, Ecosystem Management Strategy, Education and Information Strategy, and Research. These are the five points that will be highlighted in our presentation.

The Premier's Round Table has decided that they would like to explore two of these issues. One of them, we are doing today. This is the budworm. In developing the Budworm Workshop, there were objectives that were set forward and they are included in your agenda for today. I will read them quickly. This is the task that we have to come up with over the next two days.

- * To identify forest protection issues associated with a budworm control program;
- *To review current forest practices and identify gaps and concerns;
- *To review new and emerging tools or technologies;
- *And to identify the essential components we should be including in a comprehensive forest protection strategy for New Brunswick.

As Minister Graham indicated, I think there is an opportunity to do this at the present time while we are not waiting for the planes to fly, and while we have time to collectively bring our minds together on a very complex, but important issue. An issue that certainly brings forward many divergent views on how it should be done. So, our task over the next day or two is to sit together and to, hopefully, at the end of the day or at the end of two days, come up with some recommendations. These recommendations will then be brought forward to the Premier's Round Table. They will be debated again and they will be included either as a special submission or part of the submission that will be made to the Premier and Cabinet.

The workshop format: We have two days. The first day, today, will be spent on presentations. We have a series of presenters who have been asked to make some or to prepare some presentations on very specific topics. The Steering Committee met and identified some topics of interest. We also have asked the speakers to follow this format. The speakers have all been given a specific topic. They were asked to put context to their topic, so that we know where it comes from, where it has gone and where it is going. Hopefully, they will scope the major issues. We do not have time for all the details. But, what we would like to know is where we come from, where we are at the present time, and then really point out the areas of concerns. Where are the *major concerns* within each of these topics?

In two days, we do not have a lot of time for varying issues. So, we have given the speakers a task in which they will identify two Strategic Options. And, if they had tomorrow to try to solve the problems we are discussing today, what are the two strategic options they would chose. We also asked them to be a bit more specific, in that one should be short-term and one should be long-term. If those issues have to be solved, there are some that may need to be solved in the short-term. The short-term might be a five-year period, and the long-term might be a forest rotation period. We have asked that they identify a problem. How should we solve it, and possibly who could be the Lead Agents who could move it forward. Then, tomorrow becomes part of the process. Because tomorrow we will have break-out groups.

We will have four or five break-out groups, depending on the numbers that we have. Rather than scoping all of the issues, the break-out groups will take the topics that were brought forward from the speakers. The task for each break-out group is to have two topics to discuss. Hopefully, with the presenters we have, we could refocus the topics to maybe ten or twelve, because I am sure some will overlap. The activity for the break-out groups is that you have two topics to address, one short-term and one long-term. What is important, is the action plan that goes along with it. That is what we would like to get from the break-out groups, an action plan. Because the Round Table does not want to go back to the Premier with fifty recommendations. This will not work. What we would like is, if we could come down to five or six or maybe eight recommendations with strategic actions. This is the best way that we can help to make the forest stay. Hopefully, we can focus the major points. That is part of our task. To refocus these major elements. The problem will be to keep the groups on two topics. You may want to discuss all of the twelve topics. But, we are going to try to make sure that the facilitators ensure that you develop these two topics. Maureen will break you up into groups, so you do not even have a choice. This is an organized democracy. You do not even have a choice as to the groups that you are going to go to. One of the reasons is that we want to have a good cross section of ideas within all the groups. We also want the presenters who have brought forth the ideas to be within the groups. When the presenter brings forth an idea, tomorrow, he will be in the group to expand upon it. You will have the expertise within that group. We are doing some engineering of the groups in order to try to get them to function properly.

If you have any problems with the groups that you are associated with, we are flexible, we will change. If you have a problem for whatever reason, we will accommodate the changes. At the end of the day, we want to have these issues identified. What can we do? What do we want to do? When do we do it? How do we do it? Who will do it? If we have the questions properly circumscribed and have those answers; we will be prepared to move forward to the Premier's Round Table. At the end of the day tomorrow, the conclusions from the workshop will be final. Then, these conclusions will go to the Premier's Round Table. We want you to understand that what you are putting forward is what goes to the Premier's Round Table. Then, we will have the final comments, and we can go home and see what happens.

Do you have any questions before we start? If not, we can start with the first presenter. I would ask the first presenter, Eldon Eveleigh, to come forward. Dr. Eveleigh will talk about the historical overview of the budworm cycles and the future outlook. Eldon Eveleigh is from the Canadian Forest Service.

3.1 HISTORICAL REVIEW OF THE BUDWORM CYCLE AND MODELLING CAPABILITIES

Eldon Eveleigh: Good morning everyone. Being the first speaker of the morning, it is my privilege, or my duty, to introduce the spruce budworm and the ecological complexity of the budworm system. I would like to start off by giving a brief overview of the biology of the spruce budworm, its life cycle, and the damage that it causes. Then, I will look at the historical trends in budworm population cycles and see if they can tell us anything about what we might expect in the future. Then, I will look at some of the major organisms that make up the spruce budworm-interaction food web or the food chain. These are the organisms that drive the population cycles. Then, I will look very briefly at some issues that might be involved in forest protection or spruce budworm management, and I will present a couple of options that we might consider. Finally, I will look at the lead agencies that might undertake these options.

We all know that the spruce budworm is a very devastating insect. One of the reasons why the spruce budworm is such a devastating insect is because each female has the potential to lay about 200 eggs.

Then, as it proceeds through its larval development or through its caterpillar stage, and there are six larval instars, it can consume a lot of foliage. First, the female moths lay their eggs in batches on the needles. Then, the budworm goes through its larval development, starting with the first instar, which emerges from the eggs. This instar does not feed, but it molts into the second instar. This second instar is the instar in which the budworm spends the winter. Then, it wakes up in the spring and starts to mine into the needles. Then, it will molt into the third instar, into the fourth instar, and into the fifth instar. During this time, it is getting progressively larger as it consumes more and more food, until it gets to the sixth instar, which is a large caterpillar. It is in this particular instar that the budworm will consume about 90% of all the foliage that it will consume during its life cycle. A lot of time, effort and money, etc. have been spent in trying to protect the foliage before the budworm reaches this instar. Then, the budworm molts to the pupal stage. At this stage, it does not feed. If the budworm is lucky, it will then molt into a moth, and the life-cycle is completed.

We know that if the density of larvae reaches very high levels, and if it remains at very high levels for a period of four to five years, then the larvae will do a lot of damage to the trees. In a lot of cases, the trees will die. We also know that at a given density of larvae, they will cause more damage on balsam fir than they will on white spruce, on red spruce or on black spruce.

Because it has been about five or ten years since the last outbreak subsided, here are a few pictures to remind us of what sort of damage larvae can do. This is what some trees looked like in a plot that we have been working in for a number of years, about four years before the peak of an outbreak. As you can see, the trees are nice, green and healthy looking. But, this is what they looked like four years later at the peak of an outbreak, after they had been fed upon by very large densities of larvae. Some trees are now gray, some are dying, and others are red. This is what these same trees looked like five years after that. Now there is quite a lot of death. But, this is not just an isolated case - this damage does not occur just in isolated stands. It occurs over a wide area in New Brunswick, as you can see in this slide here, taken over Fundy Park. Furthermore, it is not just a New Brunswick problem. The problem occurs country-wide. It occurs all over Eastern North America.

This is a map of Canada showing the areas of significant defoliation during the period between 1980 and 1995, which covers the last outbreak. The areas of defoliation are shown in red. The other colours are just different ecozones that occur in Canada. We have significant defoliation in many parts of the Atlantic Provinces, in Québec, Ontario, Manitoba, across the Prairies, Northern BC, and even up into the Northwest Territories. To put this into perspective, the total defoliated area was approximately 72 million hectares, which is about ten times the size of the province of New Brunswick. So, it is not just a New Brunswick problem, it is a country-wide problem.

The question that comes to mind is "Can we expect this sort of damage to occur again, can we expect another outbreak?" According to Tom Royama at our lab, the budworm undergoes outbreaks on the average of about every thirty to forty years. Tom Royama has done a lot of research into the spruce budworm, and this was published in 1984 and 1992, so you can look it up. We have undergone seven different outbreaks since the mid-1700s. If history repeats itself, and barring any miracle, we can expect an outbreak any time in the near future. Then, the question becomes, "Why do spruce budworm populations cycle? What have we learned so far?" In other words, what have we learned over the last few years that can help us in the future.

In order to find out why budworm populations cycle, you have to do a lot of intensive field work, and that is what we have been doing over the last fifteen years in New Brunswick. We have been working in three different plots. The first two plots are just outside Fredericton at the Acadia Forest Experiment Station. Plot three is in the Northwestern part of the province, near Saint-Quentin. This is the population density or the trends in the population that we have been studying over the years. This is the density of the second instar, which overwinters. It is expressed as a number per square metre of foliage, which is equivalent to about three or four average mid-crown branches. I should point out that this is a log scale so, one is 10, two is 100, and three is 1000. So far, we have studied outbreak populations in two plots, declining populations in three plots, and low-level populations, now, in one plot. One interesting thing to notice is that at outbreak levels, the populations can remain at very high densities for a number of years, somewhere in the order of 500 to 800 larvae per square metre of foliage. When the population declines, there is hardly any warning, it just drops.

What did we gain or what knowledge do we have for doing this, realizing that this is still a work in progress? We are still putting the pieces together and analyzing data but, we have learned two basic things. The first thing is that the budworm - fir - spruce ecosystem is extremely complex. It is probably one of the most complex systems involving a forest pest that has ever been studied. This is because it involves a very impressive array of different organisms. We also know that it is the density of these organisms and their interactions with the budworm and with each other that determines the overall population behaviour of the budworm.

These are the major players in the budworm interaction food web or the food chain. The arrows represent some of the possible interactions that can occur between them. For example, the budworm feeds on fir/spruce. The higher the density of the budworm, the more damage it does to the trees. But, the trees also have an influence on the budworm. For example, the status of the health of the trees or the amount of defoliation can affect the aspects of budworm reproduction or alter their migration rates. Then, we have the 3 major groups of natural control agents of the spruce budworm. One groupe is predators. Here, I am talking about organisms like birds, squirrels, mice, spiders, ants, etc. Then, we have what we call the primary parasitoids. These are parasitic insects - parasitic wasps and parasitic flies that lay their eggs either on the outside or the inside of the budworm. Then, they proceed to kill the budworm as they develop. Here, in New Brunswick, we have a large complex of these parasites. For example, we have about twelve different species that belong to a group that looks like the parasitic wasp shown here. We have another group of parasitic wasps that have eight different species in it that attack the budworm. We also have a group of four different species that look like this tiny wasp shown here that is only about a millimetre to a millimetre and a half in total length. Then, we have a group of nine different species of parasitic flies that also attack the budworm. So, altogether here in New Brunswick, we have thirty-three different parasite species that attack the budworm. Throughout its range across North America, there is something like 65 or 70 different parasitic insects that attack the budworm.

Finally, we have another group of nature control agents called pathogens. These are diseases that infect the budworm and kill them.

Again, we have quite a large number of those belonging to five different groups. We have four different species of protozoa, four different types of viruses, eight different species of pathogenic fungi. We also have B.t. and Bc. (*Bacillus cereus*), that infect the budworm, and probably some other bacteria which we really have not identified yet and determined their pathogenicity. Again, we do not know very much about them but, altogether, there is quite a large complex. The larger the density of these natural control agents, the lower the budworm density will be and the less impact it will have on the trees.

What we found out, through our studies, in a nutshell, is that when the budworm is at high population levels, there is very little mortality. Otherwise, the density would not be high. During that period, most of the mortality that does occur is due to parasitism and diseases. However, when the population declines, there is an increase in mortality and this increase is due to an increase of parasitism and diseases. So, the population is brought down by the action of natural enemies, primarily parasites and diseases. Predators also play a role but, from what we can see from our data at the moment, they do not play as big a role as the parasites and diseases.

What happens when the population is low, in the red colour? This is a period that is extremely difficult for us to study because there are very few natural budworm around for us to collect and to study. We may have only as many as one larva per tree. Therefore, we had to use manipulative experiments, and we discovered two very interesting things. The first thing was that the parasite complex, at this low budworm population level, is qualitatively and quantitatively different from what it is at outbreak and declining levels. In other words, certain parasite species that were abundant at outbreak and declining levels are no longer very abundant at low levels. That does not mean that they are extinct, it means that they do not attack budworm very often at low levels.

Then we found that there are some parasites that did not really exist or that were absent at outbreak or declining levels, that started to attack low level budworm populations. We also found that at this level, most of the mortality is due to predators, particularly invertebrate predators, like spiders and ants. There is very little mortality from diseases at that level.

So, here we are now in New Brunswick, at this low population level. What must happen for us to be able to keep the population at that level? Here is some very simple math to put things in perspective. The average fecundity per female is about 200 eggs. If the average sex ratio is one to one (1:1), in other words, one male to one female, and if two offspring survive, in other words, exact replacement of the parents, or we get 198 out of 200 eggs dying, ie, 99% mortality, then we have exactly zero population growth. In other words, the population next year will stay exactly where it is this year. However, if we get four offspring surviving, which means that 196 out of 200 eggs must die, ie, 98% mortality or a decrease in mortality of only 1%, then the population will double. Thus, it does not take much math to figure out that if the population doubles every year, that in about ten years, we will have a 1000-fold increase in the population. And, that does indeed happen. We must get greater than 99% mortality for the population to decline even further. So, the question becomes, what causes spruce budworm populations to increase? What initiates an outbreak? Why can't we depend upon natural control agent to stop this increase? We have not been able to study an increasing population in our plot yet, because the population has not been increased. But, we know that for a budworm population to increase, there must be less mortality from these natural control agents. Otherwise, the population would not increase. But, the question then becomes, when the population starts to increase, why can't these natural control agents, particularly the parasitoids, stop the population from increasing so rapidly? In other words, what makes these parasites so ineffective?

Through studies on these parasites, we found that they have their own natural enemies. There are groups of parasitic wasps that attack and kill them. Also, parasites that spend the winter in the ground are heavily attacked by predators.

Thus, when the budworm population starts to increase, these parasites cannot multiply fast enough to keep up with this increase, because they have their own natural enemies - their own natural control agents. So, the population keeps on increasing until the parasites and diseases catch up. We also found that these secondary parasites, or what we call hyperparasites, also have their own parasites, called tertiary parasites. These very small parasitic wasps attack these secondary wasps.

Unfortunately, there are not very many of those tertiaries because if there were a lot of them, there would be fewer secondary and consequently more primary parasites. That is the way the system works.

Now to make the picture more complete, we have also found that many of these primary parasites have two generations in a year. The first generation attacks budworm, while the second generation must attack another host in order to complete their life cycle and to survive the winter. These hosts are other defoliators or other caterpillars that live on other trees. By other trees, I mean trees other than fir and spruce; such as hardwood, shrubs, etc. We found that secondary and tertiary parasites also have two generations. The second generation must attack other parasites that happen to be the primary parasites that attack the other defoliators. Thus, we have a very complex system, and what determines the budworm density in a given year and where we are in the population cycle depends upon the density and the dynamics of the interactions among all the organisms mentioned. This system has evolved over thousands and thousands of years.

So, when will the next outbreak occur? How high will the population go? How long will the outbreak last? The answers to these questions will all depend on what is happening in this complex ecological system, which we are only beginning to understand now. It is because of this complexity that there are no simple, easy or quick solutions to the budworm problem.

Given the fact that a budworm outbreak is inevitable in the near future, then what sort of management approach can we take? One possible approach to take is a reactive approach. Basically, the reactive approach is foliage protection, in other words, crisis management. In this reactive approach, we wait until the budworm does its job. When the foliage starts to turn red, we try to do something to protect the foliage. Fortunately, it does not require a lot of detailed information. Survey information would probably be sufficient. In other words, you can go out once a year, assess the population, assess the defoliation, and then try to take some action.

The other possible approach to take is a proactive approach, which is population suppression or population control. In this proactive approach, we do not wait until the trees start to turn red or gray. We try to do something about the population before that. However, this requires a very detailed understanding of population behaviour, forest ecology, silvicultural techniques, etc. The third approach to take is a non-active approach. This approach means that we do nothing, we just let nature take its course. When I put this presentation together, I assumed that we would want to consider a proactive approach. That is because if we did achieve population suppression, then automatically, we would get foliage protection. Also, proactive sounds more positive than a negative, reactive, crisis management approach.

Since we have to come up with issues or topics for discussions, I have prepared a list. It is not an exhaustive list and the items on the list are not mutually exclusive and they are not all my ideas. The first issue or topic that I considered in a proactive approach is biological control, IPM or integrated pest management. Biological control is the use of pathogens, predators, parasites to intervene in the population and hopefully suppress it. These natural control agents could be the ones that already exist in the system. In other words, the ones that I have already talked about. Or, they could be ones that are imported or exotics, as we call them. Just like in biological control, IPM is the use of parasites, pathogens and diseases, except that with IPM, you use them in conjunction with other tools, like pheromones and silvicultural techniques. You use them all in a coordinated, integrated manner. Then, the question is when do we use biological control or integrated pest management? Do we want to use it when the population is still at a low level in order to keep the population at the low level and prolong the endemic period? In other words, give the trees a longer period to grow? Or, do we wait until later, and then try to do something? The question becomes what do we use? What tools are available? Do we have anything on the market that we can use?

The second item on the list is Early Intervention. This issue has been talked about quite a bit in the last few years. Early intervention means intervening in the population just when it starts to increase. It means intervening in the population before it gets out of control. Then, the question becomes, how do we detect an increasing population? What tools are available?

I think Nelson will be talking about this later. We know that the populations fluctuate quite wildly from year to year. Do we have the ability to be able to detect an increasing population out of these fluctuating numbers? When do we do early intervention? How early is early intervention? What tools do we use? Is there anything available? Ed Kettela will be discussing this in his presentation, later on today.

A third option on my list is the influence of Forest and Stand Structure. What do I mean by that? There are data by Dave MacLean and his group at CFS that suggest that the greater the hardwood component in a stand, the less defoliation that balsam fir will suffer. The reason for this is not really known. We do not understand the mechanism for that. There are a number of hypotheses that may be put forth, one being that some of the natural enemies of the budworm require the defoliators that live on hardwood trees in order to survive. That could be a factor. This is something, I am sure, that Dave will talk about later. But, the question is how do you do that? How do we influence forest and stand structure? How do we manage or plant a mixed forest? What proportions should we use? These are questions that have to be looked at.

A fourth option is the plantation of Non-Susceptible tree species. As I said earlier, balsam fir suffers more damage from a given density of budworm than does white spruce, red spruce or black spruce. Do we want to plant more black spruce? Is that really realistic? Does it solve any problems or does it create other problems? For example, does it create a more susceptible forest to the yellowheaded sawfly?

The final option is to develop Silvicultural Methods to improve tree tolerance to defoliation. Some data would suggest that more vigorous, healthy trees are more able to withstand defoliation. What about thinning? Does that improve tolerance? Or, do we use silvicultural techniques like looking at the survivors of spruce budworm outbreaks? Should we be looking at the trees that are prolific epicormic shoot producers as suggested by Harald Piene and his group at our lab? And again, how do we do that? These are all things that should be put on the table for discussion. I do not have all the answers to these five issues or topics that are listed.

However, having to come up with some strategic options, I will look at what I consider to be our long-term option first. I would say that we have no option but to get a better and thorough understanding of population behaviour, particularly at the endemic and increasing population levels. An understanding of population behaviour is absolutely essential for any work that is to be done in forecasting, intervention or prevention of outbreaks. Forecasting is the development of better tools for detecting and monitoring populations. Understanding population behaviour is essential for interpreting the data and for any work that is done in IPM and in Decision Support Systems. All these systems rely upon a thorough understanding of population behaviour.

Intervention is the conservation of the natural enemies that already exist in the system. Intervention is also the development of better control agents through bioengineering or importation of exotic organisms, and in the development of tactics for their use. A more thorough understanding of population behaviour is essential for the planning of better strategies for combating the pest and in the overall management of the forest resource itself. From my point of view, we have no other options but to have a better understanding of population behaviour. This is absolutely essential because everything must be based upon our ability to understand the science involved.

My short-term to long-term option is on Early Intervention. I would advocate using an IPM approach. However, I have no idea if Early Intervention will ever work. I understand, and I know, that trying to suppress an increasing population is going to be a tremendous task. However, I say that we have no option but to try it. Furthermore, at the very least, the information that we gain from doing this will be essential for understanding how populations increase and what we can do in the future.

The Lead Agencies that I see undertaking these options are the Canadian Forest Service and the University of New Brunswick. These agencies have the research facilities and capabilities to undertake these options. However, we do need and require the full cooperation and support of the New Brunswick Department of Natural Resources and Energy and industries. These industries are both the forest industries and the industries that are involved in developing control products.

As we all know, research is not cheap and research money is dwindling every year. I can confidently say that if we do not form partnerships, nothing will be done against the spruce budworm. Thank you very much.

Louis LaPierre: Thank you very much Dr. Eveleigh. Are there any questions? No questions at all. If not then, I will ask one. I was interested in the comment you made on importing species, exotics. Doesn't it have the potential to cause other problems?

Eldon Eveleigh: Yes, it does. There are a few records in the literature, which say that there can be problems with importing exotic species. However, today, there are quite stringent protocols that have been developed for the importation of any exotic organisms. They have to go through a thorough screening process. For example, if you are importing parasites, you cannot import cocoons that may contain natural enemies, like hyperparasites or secondary parasites, which can infect other organisms in the system. As I said, there is a stringent protocol now in place with regard to importation of exotics.

Unidentified: On the population dynamics, I was wondering what the state of the knowledge is right now about budworm coming in from adjacent areas. Does the population develop from the resident population all the time?

Eldon Eveleigh: In the past, it was thought that budworm outbreaks occurred from epicentres. The idea was born from the fact that moths would come in and start a local population or they would cause a local population increase. However, it has been subsequently shown, from reanalysis of the data, that it is not the way outbreaks occur. We see outbreaks occurring in areas where the population rises first. It looks like an epicentre, but really, the population is at a low level everywhere but, for some reason, in certain areas, the population will start to increase in those areas first. So, it looks like it starts at point X and then moves out from there, which is really not the case.

Once you get an increasing population in an area and if you get an influx of moths in that same area, the population will increase even faster. So, there is a role for migrating populations. But as far as we can tell from the data, this migration does not really start the population increase. Looking at the historical data, we found that populations increase more or less synchronously, given a four or five-year lag, over a wide geographical area. In fact, I think, right now, they are starting to increase in Québec. That is a sign that they can start to increase anywhere in the near future. That does not mean that the populations in Québec are influencing the populations, here, in New Brunswick. However, it appears that we are at that point in the cycle, now, where populations will start to increase. When populations decrease, you will notice, from the historical data, that they all decrease in a more or less synchronized manner, give or take a few years, across a wide geographical area.

Unidentified: I am curious on your opinion on the reactive approach, as you described it. In other words, spraying. I presume you mean in prolonging the population or allowing it to continue its pace. Protecting certain areas is probably what the reactive approach normally does. But, what is your opinion on that? I have noticed your seven epidemics. The last one was pretty much the same as the former six which, I guess, did not take the reactive approach. Maybe, that would suggest that there is not much effect from this approach.

Eldon Eveleigh: From the literature and the work that has been done, from looking at outbreaks prior to any forest protection operation or any spray operation, and from looking at the populations after the spray operation came into effect, there does not seem to be any data that support the notion that outbreaks are longer in duration. There is also no data which support the notion that populations go higher or that they go lower with spray operations. The pattern that you see is that the outbreaks still occur with the same cycle as before. In certain areas, populations will go higher than in other areas. That is a natural event. It is unfortunate that I did not have the data that we are putting together with DNR&E. This data include the historical trends in populations all across the province of New Brunswick.

The populations are more or less in synchrony and the levels are about the same. However, in certain areas, they do go higher than in others but, that does not necessarily correlate with the spray operation. Populations will increase, regardless.

Unidentified: The two strategic options that you list, population behaviour and Early Intervention. Work has been going on in those areas for a while, either internally within CFS or in other projects. Could you elaborate on the things that need to be done, that are not being done now, or that could be done? What are the specifics that you would like to do if you had a budget?

Eldon Eveleigh: First of all, at the endemic levels, we need the resources to be able to put an experimental program into the field. This is very labour intensive because there are not enough natural budworm or wild populations to study. We get such a low density of budworm that we just do not get enough to study. So, first, you need to implant budworm on the trees. Then you follow the budworm just about every day to find out what is happening to them, what is the status of their health, what is attacking them, etc. We need to continue that until we start to see a population increase. This is a much more precise method for determining a population increase than doing pheromone trapping or any other type of trapping techniques. When you look at the populations throughout their cycles, you can look at generation survival - the survival from egg to egg. You can partition the survival into groups to find out where survival is most important. We found out that the survival between the third larval instar and the pupal stage is really what drives the budworm population cycle. By doing these operations, and by doing these field experiments, you can determine when the survival really starts to swing up. This is much more precise than studying any one particular stage, because the survival has been averaged across all the stages, i.e., the average gets away from some of the natural variation. Therefore, you are able to determine or detect the population increase more precisely. However, that requires a lot of resources. For a population increase, we have to know exactly what initiates that outbreak. Why do the natural enemies not remain effective? What happens there? How can we intervene in that situation? How do we augment the natural control agents that exist to keep the population there? That would be a very important piece of research.

Then, when the population starts to increase, we need to know what opportunities are available. When should we attack or put in place control measures to best intervene in the population? Should we do it earlier in order to conserve the natural enemy complex that is there? Remember that when the budworm population is increasing, there is a lack of natural control. So, when you start to put any sort of suppression effort into effect, you have to make up for the lack of natural control that already exists. We have to know how much we have to make up. And, when it is best to do that. The list will go on and on.

Louis LaPierre: Thank you very much Dr. Eveleigh. We have a session for questions and discussions at the end of the day. So, if any of you have any questions that come up and you want to ask the speakers, we will have that opportunity this afternoon.

I would like to ask Nelson Carter to make his presentation. Mr. Carter certainly does double duty in this workshop. He helps and does all the work in organizing the conference. And, then, he is also always ready to speak. Mr. Carter will speak on the methods or tools for forecasting spruce budworm.

3.2 FORECASTING TOOLS AND METHODOLOGIES

Nelson Carter: Thank you very much Dr. LaPierre. Dr. Eveleigh has done an excellent job of laying the ground-work for me. It has made my job a lot easier. Some things that I wanted to get into, like discuss the background to monitoring and forecasting of budworm populations, Eldon has already covered. So, thank you very much Eldon. The title of my presentation is *Methods of Forecasting Spruce Budworm Populations*. As I indicated, Eldon has done an excellent job in putting this into perspective as to where we are in population dynamics. We are just coming off the seventh outbreak from a series going back to the 1700's. Certainly, things have changed over those years. I am not going to refer to any of the early outbreaks. My presentation will cover i) Egg Mass Surveys and ii) L2 Surveys. L2, as already mentioned in the second instar spruce budworm larvae. So, that is what the L2 Surveys refer to in my presentation.

If I refer to an L2, I am talking about the second instar larva that spends the Winter. iii) Pheromone Trapping Surveys to monitor male moths. I will mention a couple of iv) Major Issues associated with forecasting budworm populations in light of current conditions. I will also mention some v) Options: short-term and long-term options. Finally, I will talk about who should be the vi) Lead Agencies.

The traditional purpose of forecasting budworm populations has been to identify areas of moderate to high populations where protection was needed. What we are looking for in forest management and ecosystem management, is a green and a healthy forest, not a red and sick forest, nor a grey and dead forest. The traditional purpose of the forecasting system was to identify populations capable of causing severe defoliation and trees to die and to initiate control programs to prevent that. Eldon went through the four main life stages of the spruce budworm (egg, larva, pupal, adult). So, I will not get into those details.

But, as far as monitoring and forecasting populations are concerned, I would like to indicate that population tables have been established for each of these life stages over the years. These tables are used for putting populations in various categories. However, data for the pupal stage has not been traditionally used for forecasting populations. So, I will not have anything to say about that stage.

I should point out that there are three main periods during the life cycle of the budworm when populations can redistribute themselves through dispersal. Adult moths, both males and females, are very good flyers. They can fly from tree-to-tree, and from stand-to-stand. When conditions are right, they can cover vast areas. They can even cover several hundred kilometres. This ties into one of the last questions about the influx of budworm moths from one area to another area, and how they might or might not influence local populations. It has been documented that female adults carrying 50% of their egg compliment can disperse from one stand to another stand. So, I think budworm moths can certainly redistribute the population. But, whether it is significant enough to cause the receiving area, to erupt any quicker, I will leave to Eldon and his colleagues to debate that one.

After hatching from the eggs, the first instar larvae are about a millimetre in size. They redistribute themselves around the branches. They can spin down on silk threads, like spiders. They can be wind blown from tree-to-tree and over shorter distances or longer distances from stand-to-stand. The second instar emerges in the Spring. They can also spin on silk threads and redistribute themselves between branches, between trees, and between stands.

The historical method for forecasting budworm populations has been the Egg Mass Survey. That was the method in vogue throughout the 1950's up to 1980's. It is still in use in some jurisdictions today. Later, I will talk about what we have transferred from the Egg Mass Survey to an L2 Survey. But, during the time period when the Egg Mass Survey was conducted in New Brunswick, it was based on establishing many plots in the softwood forest around the province. Several thousands of plots, at times, were sampled. Standard mid-crown branches and each of these plots were taken in late July. Four branches per plot were our standard sampling system. These were returned to a lab where the egg masses were counted. Then the numbers were put into categories of Low, Moderate, High or Extreme, according to the tabular values that we had established. The data for each of these plots were plotted as points on maps (at a scale of 1: 250 000) to make a Forecast map. This scale was done by hand-contouring around the perimeter of the groups of plots that fell within the same category. Then other data are added to get a Hazard map. This map was developed and used in planning a control program.

This is an example of the technique that is needed to gather the mid-crown branch samples in the field. During the days of the Eggs Mass Survey, dozens of students were hired in August. These students had to go through all the branch samples, look for the egg masses, and count them. Depending on the counts, the numbers were put into various categories. If the numbers fell below the bottom line (shown on the graph), they were placed in the Low category. If the numbers fell above the higher line, they were placed in the High category. The central portion or distance between those two lines represents sequential sampling. For example, if you had three branches and you fell above the low point, but between the two lines, this means that you had not sampled enough branches to determine whether the population was truly low or truly high.

However, operationally, we do not have time to go running back and forth to the forest to keep taking more samples. Over the years, we found that four branches at a sample location were, more often than not, sufficient to put samples into a particular category. That was adopted as a standard. Essentially, the intermediate range became known as the Moderate forecast level.

The advantages of the Egg Mass Survey were that it gave an early warning system or an early forecast of next year's populations. This early forecast gave enough time for planning a control program, budgeting, getting aircraft, insecticide, and the logistics that have to be taken care of. It is a fairly low-tech method. The disadvantages are not insurmountable, but they are associated with the system. The first disadvantage is that there is a relatively short time period during which the branches can be collected and the new egg masses can be identified. The second disadvantage is that spruce branches are harder to examine for egg masses than balsam fir. That has to do with the structure of the branches themselves. As I mentioned, that was the traditional method of forecasting budworm populations.

L2 Survey: In 1985, after a number of years of development throughout the 1970's, it was determined that in the overwintering stage of the budworm, the larvae could be washed from the branches using a sodium hydroxide solution. We could thus get a fix on the population using the overwintering second instar larvae. Again, the same idea as the traditional method, many plots are established around the Province. How many plots were there? Once, there were about 2000 plots or so. Since a decade ago, due to decline in the populations, we are now down to several hundred L2 plots. Mid-crown branches were collected in August to October. Then, the branches are returned to a lab where the larvae are extracted using a sodium hydroxide washing technique to get the larvae from overwintering sites. The larvae are counted and put in categories like the egg mass data. The data are plotted on hand-contoured Forecast maps. Again, other data are added to get a Hazard map for forecasting areas in need of protection the following year.

In the field method, it is much the same. Branches are collected from mid-crown.

Then, the branches are brought back to the lab and soaked in a 1% hot sodium hydroxide solution for several hours. After that time period has passed, the branches are put through sieves that extract the branches and the needles. The upper sieve is a coarse mesh, and the lower sieve is very fine. This fine area will capture the tiny second instar larvae. We do a double rinse. We found that by doing a double rinse, we increase the recovery of the overwintering second instar larvae in the system. This improves our forecasting method. Once the larvae are extracted in the filtering process, they are put into a separatory funnel. In this funnel, there is a layer of water, on top of which there is a layer of hexane. The hexane is there to capture the second instar larvae. The needles, the dirt and the dust that came out in the filtering system fall into the lower water layer. This layer of water can be "decanted" off, leaving you with the hexane layer. Then, that is put into a funnel system and the larvae are captured on "gridded" filter paper. Then, the larvae are put under a microscope, and trained people can count the number of larvae that are at the particular sample point. Larvae are categorized using this system.

In this system, if the number of L2' s on the branch is between zero and six, we regard that as a Low population. A Moderate population would be from seven to twenty larvae. A High population would be from twenty to forty larvae. Once we get more than forty L2' s per sample, we get into an Extreme population. These population categories are inferring something about potential defoliation. Low populations mean a forecast of Light defoliation somewhere between barely detectable to maybe 30% defoliation. And, 30% defoliation is barely detectable from the air. The Moderate category or moderate defoliation is a broad range from 30% to 70%. The High to Extreme populations, meaning severe defoliation or more than 70% defoliation. Defoliation is the loss of the current year's needles put on by fir spruce trees. When populations are Extreme, they can kill the buds in the Spring. They can also prevent current shoots from growing that year. And, they can be so extreme, that they can feed on older classes of foliage. The foliage on the trees is what is required for them to grow.

Here is an example of a Moncton map sheet showing the distribution of the survey plots. This map was done in 1986 for the forecast of 1987.

This map shows the contouring around groups of plots that fell within the same category. It leads to a typical Forecast map. Then we would integrate defoliation information and Susceptible Forest information to generate a Hazard map. This Hazard map is used for planning a control program.

The advantages of the L2 Survey are that it takes into account the dispersal of the first instar larvae from the egg stage. There is a longer sampling period available for carrying out the survey, if needed. This sampling period begins in late August. Then, we try to have the forecast ready by October, to provide for planning control programs. Supplementary sampling can be done throughout the whole Winter. It can also be done into Spring before any larvae emerge the following year, and if we need to refine the forecast. In the process, we handle spruce samples as easily as fir. It is less labour intensive in terms of the number of counters. It is also cheaper than the Egg Survey. The downside of the L2 Survey is that specialized lab facilities are needed. But, once you have those lab facilities in place, then, that is one of the tools we depend upon.

Recent data based on L2 Surveys have revealed that, over the last decade, declining populations have been evident. Almost 100% of the branch samples that we take are negative. In other words, we do not find any budworm larvae. In 1996, we only found four larvae in 500 of our operational plots. This past year, we only found two larvae in 300 plots. Over those two years, it averages out to about one larva per 400 branches. This means that when budworm populations are low, they are very low. And, they are very difficult to detect. How can L2 Surveys be used in terms of forecasting populations under these conditions?

This leads us to the future or the current method that is based on Pheromone Trapping of male moths. Even though populations are extremely low, it does not mean that the budworm has gone away. The budworm has not self-destructed. The budworm does exist out there, and studies have demonstrated this. Studies have also demonstrated that, in getting ready to propagate the species, the female moths emit a pheromone. This pheromone is detected by the male moths and this brings the female moths and the male moths into contact, and the mating takes place. Then, the eggs are laid, and so on. Researchers have identified that sex pheromones have been able to synthesize it.

The pheromone can be put into a special lure. Then, it can be put into special traps and the traps can be put into the forest. These traps are used to attract the male moths into them. Then, the male moths can be counted to give you an index of the population. Even though we cannot detect populations of second instar larvae, by taking branch samples, we can still find populations of budworm by moth counts. So, we are establishing a network of plots around the Province.

The traps are normally set out from late May to late June. The pheromone is fairly robust. It maintains its usefulness for four to six weeks. We have a good time period which to get the traps established. Then, the traps can be collected in August or maybe later, if we need to. The count of the male moths, in the traps, can be done directly on site. If the numbers are low, it does not take very long to count the moths in the trap. However, one must know how to distinguish male spruce budworm from any other critters that might stray into the traps. If the counts are very high, they can be returned to the lab and the moths can be counted there. Once we have these numbers, they have to be analysed in some fashion like the Egg Mass Survey or the L2 Survey.

In the last number of years, there is a fancy term that has been used, called "Kriging". This term refers to a statistical method for taking these data and interpreting them. Essentially, "Kriging" assumes that values are auto-correlated. Then, it establishes a population gradient between them. This Kriging system can interpolate statistically between these various values of high and low counts of budworm moths. Instead of hand-contouring around areas, the Kriging system will establish the zones of different population categories.

Here is a slide of a typical pheromone trap that is put out to capture male moths. The pheromone lure is placed in the top portion of the trap. There is a small strip of Vapona (killing strip) in the bucket part of the trap. When the male moths come in as they are attracted to the lure, they get exposed to the odour given off by the Vapona. The male moths die, and fall down into the traps. Then, they can be counted. This is an example of a Kriged surface map for New Brunswick using the 1996 data. The green areas on the map are the lowest counts for that year. The red areas on the map are the highest counts for that same year.

The gradation being from green, to yellow, to orange, to red in terms of increasing population density. I want to caution that this is a relative system. It does not mean that the red is severe and that the green colour is low. This system is the relative relationship from the lowest counts, that year, to the highest counts in the same year. So, you can see that the system will interpret for us where the populations fall into those categories.

The advantage of the system is that it is simple to put out these traps. The disadvantage is that it requires two trips whereas in the Egg Mass Survey and in the L2 Survey, we just go out and take branch samples once. Then, we bring the samples to the lab and do the processing. In the Pheromone Trapping System, we have to go place your traps out, wait a time period, and then, come back and pick them up again. So, we have to make two trips to the site. Therefore, it is more costly in that aspect, even though some of the other costs might be lower. Trap losses can occur from bears or other critters that like to climb trees and see fancy things. Then, they knock the traps down and step on them. If the traps are not secured properly, they can be wind blown onto the ground. In some instance, they have been used for target practice by some hunters.

Standardization of the pheromone is something that we have to be very careful of. There are only a couple of people or companies who can provide the lure and the pheromone. But, the strength of the lure needs to be constant between years, so that we do not artificially get higher counts in one year or lower counts in another year, because the lure was either higher in concentration or lower in concentration.

Interpretation of the data is yet to be determined. The Kriged surface map that was shown was just one year's data. It is not difficult to interpret one year's data. We just look at which populations are higher and which populations are lower. But, we have no standardized "look up tables" that we can give the meaning of the numbers. The numbers may mean increasing populations or stable populations. That is something that is being worked on. Just as our L2 populations have declined to the point where the budworm larvae are very rare, the moths catches are also declining. In 1996, 53% of our traps were empty. In 1997, 73% of the traps were empty.

When we are dealing with empty traps, there is not much statistical analysis we can do. So, the interpretation of the data is yet to be determined. We think we know what we want to do with the data, but locally, we do not have a database where we can play those games. We have to look to our colleagues and other jurisdictions to show us some guidance.

The Major Issues facing forecasting budworm populations are to determine when and where population increases signal the next outbreak. I think Eldon gave a good example of why we want to be ready for the next outbreak. Can that be done? Can it be used in an alternative control strategy? Again, Eldon laid the ground work for that in term of an early intervention strategy. Other speakers, like Dave MacLean, Ed Kettela, and others will probably speak about tools that might be available to be used in these alternate strategies.

From my perspective, the short-term and the long-term Options are that we need to maintain a Pheromone Trapping System to monitor population changes. If this system signal that we need to revert back to an L2 sampling system, we can do that fairly readily.

We need to maintain cooperation with the Canadian Forest Service (CFS) and others regarding research on the development of alternative control methods. We want to look at our historic L2 data to determine whether the thresholds that I indicated, or others are more valid thresholds, that could be used. I caution that we were forecasting on the declining side of a population outbreak. Even though we might now look at lower thresholds, we are not sure that when the population goes up again, that we might not need to look at a different set of thresholds.

Finally, the Lead Agencies: Our Department (the Department of Natural Resources and Energy) has the lead role in operationally forecasting budworm population levels. We need the collaboration and the cooperation of the Canadian Forest Service. We also need the development of alternative techniques, the interpretation and the data. If we are getting into alternative control strategies in the future, Forest Protection Limited is an agency which represents, not only the Department of Natural Resources and Energy, but also the four major forest industries in the Province.

A lot of the money that goes into research for these tools is funnelled through Forest Protection. This money is also funnelled through a cost-sharing program between government and the industry; essentially a 50/50 shared program. So, that is all that I have to say about forecasting spruce budworm populations.

Louis LaPierre: Thank you very much Mr. Carter. Are there any questions for Mr. Carter?

Unidentified: Mr. Carter, can you talk more about pheromone trapping? Did I hear you suggest that maybe it could replace L2 Surveys? How are L2 Surveys and pheromone going to relate in the future, as far as monitoring tools?

Nelson Carter: When budworm populations are very low, the traditional sampling of L2 Surveys, the way we do it now, may not detect the populations. So, the comforting level is that we can still forecast the populations that are low. As populations increase up to the one to ten larvae per branch category, then we know what those numbers mean. When populations are lower than that and we get these "empty" samples, we are not finding anything. Therefore, it might be kind of useless to do that. However, I think that is false reasoning.

The pheromone system is perceived as being more sensitive to changes of population levels at lower densities. We are hoping to use the pheromone system as an early warning system where populations are increasing. This means that an alternative strategy could be put into place. This alternative strategy will detect the population much earlier than the L2 Surveys will. By the time we detect the larvae in an L2 Survey, the population is already across the threshold where an outbreak is already underway. Therefore, you have missed that opportunity to do that early intervention. The perception is that the L2 Survey is good for forecasting defoliation and good for planning programs to prevent or to address the objective of preserving foliage. But, the Pheromone Trapping System might be more sensitive to alert us and give us the opportunity to intervene earlier. This is where the question lies, between the population dynamics, people, the forest industries, the Departments, ourselves, and even people who sit back and view our strategies.

Can you really interfere with the populations? Can you really suppress them? This is the big question. Personally, I do not see replacing the L2 Survey with a Pheromone Survey for forecasting populations when defoliation is present. Because, when you get into that, you can get hundreds of moths, even thousands of moths in those traps. Therefore, the Pheromone Surveys become not as sensitive or not as practical to use as going back to the L2 Survey.

Louis LaPierre: Any additional questions?

Unidentified: Mr. Carter, do you have an idea of the range that a trap covers? And, is there any difference between lower in the crown and higher in the crown?

Nelson Carter: No and yes. The range of attractiveness for the lure, and I am sure it has been documented, but I cannot recall that figure to mind, right now. It could be as much as a kilometre down wind. From the source of the lure down wind, it is going to degrade. It is going to get more diluted as you get down wind. But, if a male moth is down wind of the trap, then I presume it can detect these pheromones in very low concentrations. And, it can probably come "up stream" to it. The range that a trap covers is approximately a kilometre. I will refer to either Eldon Eveleigh, Ed Kettela, Dave MacLean or anybody else who might be able to recall a more precise figure to mind.

The traps do sample areas and geographical areas, but how big that is, I could not exactly say. In an effort to clarify the answer to this question, I subsequently contacted Dr. Chris Sanders, recently retired scientist with the Canadian Forest Service, and one of the foremost researchers into the development and use of spruce budworm pheromone. His reply follows:

"The answer to your question, is what you would expect from a scientist, "it depends"! In a gentle and uniform airflow, a male will respond at a range of 40 to 60 metres.

However, in the bush, things are not gentle and uniform, also, male moths do not sit and wait for the pheromone to come to them, but engage in what has been termed "appetitive flight" i.e., even in the absence of pheromone, they work their way upwind, which increases their chances of locating a pheromone plume. In a mark and release experiment, we caught one male in a light trap two miles from its release point. In a fairly dense SBW population, where there are competing females, I would allow for a "collecting circle" of about thirty metres radius. In a low density population, where males would engage in more "appetitive flight", I would push it up to 60 m."

The second part of the question was are populations different in the upper-crown, mid-crown, and lower-crown? Yes, the populations are different. It depends where the overall population cycle is and whether it is going up or down. The traps are put out at the lower-crown level, where you can hang the trap. This is better than trying to have to put up a system to get the traps up into the canopy of the trees. The salient point there is that the forecasting systems that we are using, whether it is egg mass, L2 or pheromone, are a broad category. We are not forecasting absolutes: "i.e. in that stand and on that tree, there will be ten larvae per branch." In the general area, we are forecasting populations that are Low, Moderate, High or Extreme. In those categories, you can find larval populations that are, for example, fewer than ten, more than ten, and greater than twenty, etc. So, we are putting them into categories rather than absolutes.

Dave MacLean: Is there any potential for using pheromone as a control method in times like now when there is very low population? Or, is that just one time that was talked about? Is there any practical application in that regard?

Nelson Carter: Good question, Dave. The perception is that by flooding the atmosphere in a local area with pheromone, you can disrupt mating by disorienting the male. So, the males cannot find the females. That sounds very simplistic, but in order to do that, you have to define the area over which you want to apply that tactic.

This is the key point I was trying to get across at the end of my presentation. How do we define that area of increasing populations? Budworms are over the whole range across the country, from the West Coast to the East Coast. We cannot tackle the budworm over the whole range of the population. So, locally, our dilemma is how can we apply pheromones in a control strategy to suppress populations? The identification of the population over which you would want to apply it is one key question. The second question is how much pheromone do you need to apply? What is the dosage rate? When do you apply it? Do you apply it in large droplets, in small droplets or in solid fibres? All these techniques have to be determined. I should add that research on that has not been totally shut down. When I came here, fourteen years ago, Bill Seabrook at the University and people with the Canadian Forest Service were working on the development of pheromone. A number of trials have been done, and I am sure that you have been familiar with them over the years. The Pheromone Survey cannot have an effect on egg mass density. But, we do not know the threshold at which to apply it as a treatment and the geographical area over which to apply it. To quote Bud Irving, "Even if we would have a ton of pheromone, right now, we would not know what to do with it." We could use it, but we would not use it very wisely. It is still a big research question and now is the time where we have to identify the opportunities to do that research. We have to see if we can come closer to a prescription. If we would identify a time and location to do the research, then now is the best time to do it. There have been trials done in a plan for Ontario to do some of that work last year. And, some work will be done this year to follow the research that was done here, in New Brunswick in the 1970's and 1980's.

Unidentified: Mr. Carter, I would like to know how the timing factor gets incorporated in the trapping system. Isn't there a need for a time, like the number of captures per the number of days, to rate the trapping Low, Medium or High? You leave the traps out there for an indefinite period of time. You fill out the trap, if there is a population there. But, how do you relate the trapping rate or the severity of the population?

Nelson Carter: I do not think the trapping rate is really a factor that we are trying to measure. It is the total number of moths that we get into the trap that we are trying to measure.

Whether they got there on one day, five days or ten days is something immaterial. They represent the population in the vicinity of the trap. It is the same as the L2 Survey; it does not matter how long it took to get from the egg to the first instar and to the second instar. It is how many you are left with that is really the important thing. To measure trap catch per day is not an issue in my mind. There are automatic counters that can be used to do that. Those automatic counters are used for research. I know Québec can measure trap catches per day, but, personally, I do not see it as being a needed measure in forecasting populations. It is the ultimate number that you have that counts. Then, does that number of moths relate to some other factor or does it relate to the population density?

Louis LaPierre: Thank you very much Mr. Carter. I think with those questions, we will stop again. If you have further questions, you can ask them at the session at the end of the day. Already, we are seeing some interesting topics being brought forth. As we go forward today and tomorrow, I would ask you to think about what could be most effective and what could be most cost efficient. We will take a break, as indicated in our agenda. But, first, I would like to highlight the contribution of the sponsors. They are indicated on the program. We did not charge a registration fee for this conference. The reason we were able to offer a conference without registration fee is because of the generosity of the sponsors. On behalf of all of us here, I would like to thank them for their support.

We will reconvene at 10:30. So, we will have twenty minutes to stretch, and talk. We will come back at 10:30 with the next presentation. But, it will not be Thom Erdle, as indicated in your agenda. Dr. Erdle was not able to be with us today, because he is out of the country. We have Dave MacLean who has kindly agreed to fill in. Dr. MacLean will be in when we reconvene. Thank you very much.

Before we start, I would like to indicate that when you ask a question, please identify yourself. A lot of people, here, know one another, but some people do not know each other. I would like to ask Dave MacLean, who has kindly agreed to fill in for Thom Erdle, to speak to us on the impacts of spruce budworm in New Brunswick.

This will give us some indication as to what happens in New Brunswick when the spruce budworm goes across our province.

3.3 IMPACTS OF THE SPRUCE BUDWORM IN NEW BRUNSWICK

Dave MacLean: Thank you very much, Dr. LaPierre. In general terms, everybody knows what the impact of spruce budworm is. Spruce budworm feeds on the foliage. Spruce budworm feeding reduces the growth of trees, and it increases mortality. The general outline of my presentation will be the effects of outbreaks in terms of direct reduced yield effects and indirect losses caused by non-optimal scheduling that is caused by budworm. The values affected by budworm are the timber supply, in terms of cubic metres, the quality and the products. There are also some nontimber effects on habitat and protected areas. I will propose two strategic options. The two major impacts of budworm are growth loss and mortality of the trees.

Repeated defoliation, that is removing the current foliage, year after year, reduces the growth of trees. After four, five or six years or so, you start to get the death of trees. Because spruce budworm is such a major problem, people have devoted much of their life's work to quantifying budworm effects. So, we know a lot about spruce budworm effects. There is growth reduction associated with a budworm outbreak. In Cape Breton, in the late 1970's and early '80's, a big outbreak occurred. Throughout that outbreak, some of the trees survived, and growth rates were analysed. Typically, there is an 80% to 90% reduction in growth during the active period of feeding. The pattern of growth reduction closely follows the pattern of defoliation.

Unfortunately, a lot of trees die during budworm outbreaks. On average, about 85% of mature balsam fir stand die, 40% of the immature balsam fir, 35% of mature spruce, and about 15% of immature spruce die. This "spruce" includes white, red and black spruce. White spruce are being more damaged than the red spruce, which in turn, are more damaged than the black spruce. These data came from a paper I published in 1980.

One of the first things I did, was try to get all the permanent sample plot data that people had from past outbreaks, from different areas, and different time periods. All together, there were over 100 plots from different outbreaks. I calculated average levels of mortality. I would like you to remember those average levels, because these average levels are your best indication of what you should expect when another outbreak comes along. If we would add the data that we have collected since 1980, they would just corroborate these levels. Mature balsam fir from my 1980 paper had an average of 85% mortality. But, mature balsam fir on Cape Breton Island during the 1974-82 outbreak averaged 87% mortality. So, that is the real worrying effect.

Pest outbreaks in Canada, due to the insects and the diseases, cause losses of about 80 million to 100 million cubic metres per year. That is about half of the sustainable harvest levels across Canada, the AAC level. Losses from pest outbreaks are larger than the fire losses, because it is much easier to salvage after fire. Fire tends to be in discrete areas where you can get in and salvage, and get the wood out. But, budworm outbreaks are affecting everything from Manitoba east, and there is no way you can salvage everything. 40% of the overall pest outbreak losses are caused by spruce budworm outbreaks.

I will summarize the effects of budworm outbreaks on mature stands and on young stands. You can expect 85% mortality in mature balsam fir, and around 35% mortality in mature spruce. The management options when faced with a budworm outbreak are 1) to protect by using foliage protection, keep the trees alive and keep them growing by using insecticides; 2) cut the trees by salvaging them as soon as you can until rot makes them no longer salvageable, which is probably three or four years maximum, or 3) reduce the mature balsam fir stands. Budworm has a tendency to remove the balsam fir from mixed stands, and to recycle mature balsam fir to young balsam fir stands. This is because of the nature of balsam fir, which regenerates underneath itself. Balsam fir is very shade tolerant. There is lots of advanced regeneration underneath these stands. In certain types of stands, this results in a cyclical, successional pattern. Protection with B.t. can prevent mortality.

The current foliage retention target of spraying in New Brunswick is keeping 60% of the current-year's foliage on the tree each year. This will keep the trees alive and prevent mortality. Keeping the foliage present and the trees alive has been the major historical strategy for spraying. If we can keep the cumulative defoliation at less than 40%, we can prevent mortality in mature stands.

On average, there is 40% mortality in young balsam fir stands and 15% mortality in young spruce. The mortality that was observed in young balsam fir in Cape Breton ranged from 31% to 49% in plots of spaced balsam fir. In unspaced balsam fir, the mortality observed was from 11% to 32%. These unspaced stands were very high density stands. Killing 32% of the trees in this high density stand means that a lot more trees were killed than killing half the trees in the spaced stand. Spaced trees are more vigorous, and better able to withstand and recover from defoliation. But, spaced trees are not immune to defoliation. Some are going to die. If you do not have some protection in thinned or spaced stands, you are going to lose some of the crop trees. This can be up to 40% of the crop trees. The reason for doing the thinning or the spacing is to keep the trees growing at a fast rate. The current 60% foliage retention target each year in operational protection programs is not enough to maintain growth rates and the allowable cut effect. Increasing the growth rate of trees means increasing the productivity of the landbase and being able to harvest more. The current foliage protection target will not maintain increased growth rate.

An analysis that was done in the mid 1980's, by Eric Wang and others, showed simulation of several scenarios for a 200 000 hectare forest on Fraser's License in northern New Brunswick. The five-year sustainable harvest level in millions of cubic metres, of different scenarios ranged from about 1 to 2 million m^3 , and is plotted against the amount of silvicultural treatment in the stands, spacing of the youngest age class, from none up to half of the trees. It would take several million dollars to implement this level of silviculture. The different lines on the graph are scenarios of 1) no defoliation, 2) protecting the entire forest keeping 80% of the foliage on the trees each year, 3) protecting the entire forest keeping 60% of the foliage on the trees each year, 4) protecting the immature forest with an 80% target, and 5) protecting the immature forest with a 60% target. This study showed three main results. First, without protection, yields were substantially reduced during a budworm outbreak.

Second, the degree of uncertainty associated with whether a budworm outbreak occurred and whether protection would take place was +, - 100%. And third, with 60% protection, stands were still losing growth, so much so that the allowable cut effect (increased growth rates resulting from silviculture) was being lost. So, budworm is reducing the growth rate and you are not getting the payback anymore. This is something that has to be considered, because there is a large amount of pre-commercial thinning in the province now, and in other areas. And, we have to consider the growth effects of this pre-commercial thinning.

Unfortunately, there are not many management options for budworm. Salvage harvesting, foliage protection using B.t., or trying to do something in terms of restructuring the forest to reduce damage are some possible options. I think that there are things that we can do to minimize the forest-level cubic metre losses. One of the things that has gone on for a long time is planting nonsusceptible or low susceptibility species. That is one of the reasons why black spruce is a good species to plant. In addition to its good fibre characteristics, black spruce is less damaged by budworm. I think that we can do more in terms of converting the most damaged stand types. We can also integrate this into silviculture or in harvesting plans. A point to keep in mind is that the timber demand exceeds the supply in New Brunswick. There is a net importing of supplies in New Brunswick. There is a lot of concern about shortages and whether we can maintain current levels of timber supply.

Management planning involves predicting the yield of the products you want out of your stands, and optimizing the scheduling of the activities that are going to go on. Management planning also involves harvesting at peak yields, and determining the relationship of silvicultural activities and all the other activities on the landbase to the productivity of the landbase. Budworm directly affects the yield, by causing losses from growth reductions and mortality. Budworm also affects scheduling. Thom Erdle elegantly explained the results of non-optimal scheduling in the November workshop. If you are expecting a young stand to grow and increase in volume, and you have to cut it earlier, because of budworm causing reductions over the whole landbase, then you are suffering an indirect loss or a scheduling loss.

The same type of indirect losses can happen with mature stands. If a mature stand is going to decline in volume and if you are chasing budworm and salvaging some other stand, you are not able to get to that stand when you have scheduled it. Then, you are also going to sustain a loss. These are indirect losses that are occurring with budworm. Salvage is not optimal scheduling. We will not be able to maintain present harvest levels if we are running around doing salvage harvesting. The yields and the optimal scheduling can be maintained by protection.

The question comes up, isn't our forest different now? Maybe budworm won't cause as much damage in the future? If our forest is different, it is younger, and there are different species out there. So, maybe we do not need to be worried about budworm? Maybe the past will not repeat itself? In my opinion, the forest is not different enough to make much difference in terms of the impacts. In some ways, the forest is getting "worse". Fire protection, clear cutting and budworm protection have all increased the amount of balsam fir on the landbase. Balsam fir is the most damaged host species of budworm. This is the probable reason for the increased size of outbreaks that has been observed. The three outbreaks, in the 20th century that started around 1910, 1940, and 1970, had areas of 11 million hectares, 25 million hectares, and 58 million hectares. So, the outbreaks were big, bigger and huge. The forest is generally younger now, because of our harvesting activities, and age affects losses. If we would look at the overall numbers, how many millions of cubic metres are we going to lose? A younger forest will lose less than an older forest. On the other hand, looking at productivity of the landbase, you may lose 40% of the trees from these silviculturally treated stands. If you already have 800 or 900 dollars per hectare invested in the spacing treatment and you are counting on these stands to produce at a certain rate, maybe it is more a concern then losing a mature forest.

There is also an idea that every second outbreak may be more severe, because of age effects. If we have a forest that is mainly mature balsam fir, then it is going to be killed during a budworm outbreak. But, it regenerates as balsam fir. At the time of the second outbreak, thirty or forty years later, the forest is going to be in a young condition and it is going to suffer more of a thinning or a partial mortality.

Then, the forest is going to grow on to maturity by the time of a third outbreak. That will be over the span of a century or more.

Now, I am going to talk about some decision support system work. We have a system that is called the Spruce Budworm Decision Support System (DSS) or Protection Planning System that has been implemented for all of New Brunswick. This system calculates the budworm losses at the scheduled time of harvest and it maps these cubic metres per hectare loss values. The Decision Support System uses a stand growth model and a timber supply model. The system calculates both the direct yield losses and the indirect scheduling losses. That is because we are using the existing harvest scheduling information for the landbase. The system then maps these values back on the landbase, and can be used in planning protection operations by showing where the highest priority values are. The system also has potential for use in harvests scheduling. It can be used to optimize production blocks.

For every class of stands, we are doing a projection of volume yield, whether the stand is protected or is not protected during an outbreak. We are interested in the difference between these protected and unprotected yields at the scheduled time of harvest. We calculate this for the thousands of stands that are in the forest using the computer modelling system. Then, budworm caused volume losses are mapped using different colours. In this example of a protection priority map, the shades of blue represent from 0 to 20 cubic metres per hectare losses, the shades of green are from 20 to 60 cubic metres, the shades of yellow are from 60 to 100 cubic metres, and the shades of pink and purple are from 100 to 200 cubic metres per hectare losses. The colours therefore show where the high priority (high loss) areas are. These areas would provide the highest benefit from budworm protection against budworm.

Nelson Carter's group, NBDNRE Pest Management Section, is looking at using this system for designing their protection blocks for the next budworm outbreak. One good thing about this system is you can design a protection block and calculate a wood supply benefit of that block. Then, that wood supply benefit can be compared with the cost of protection.

We have displayed a map that shows protection priority values for two of the Crown licenses in the province, Repap Licenses 3 and 4 that have been merged together.

This Figure shows the status of implementation of the Spruce Budworm DSS in New Brunswick. The areas that are in red are the areas of the province that are already completed. These include Juniper License 9, the J.D. Irving Ltd. Black Brook Freehold, and Repap Licenses 3 and 4. The areas in green are the areas that are under way, several of which are well along in terms of implementation. The areas in white are planned to be done this year, in 1998. By next Winter, we expect that all of the province will be implemented.

Another value of the second DSS is that it allows you to calculate the cubic metre and the timber supply effects of different strategies. If one possible strategy is doing nothing, then what will happen to timber supply and AAC if an outbreak occurs on a given landbase and there is no protection? How much reduction of the forest growing stock would there be? Analysis with the DSS has shown about 10 million cubic metres would be lost under a normal budworm outbreak. This is based on patterns similar to what Eldon showed you of the historical outbreaks. The second column in the table, representing a severe outbreak is more what was observed in Cape Breton. The levels of defoliation in New Brunswick were not as high as the cumulative levels of defoliation in Cape Breton. The table shows losses for the four landbases that we have completed already, at levels of 3.1 million cubic metres, 1.0 million cubic metres, 4.4 million cubic metres. Therefore, a quarter of the province, around 10 million cubic metres would be lost without protection. Losses almost double if you get into the severe outbreaks. On the protection priority maps, our scale of cubic metre losses doubles, going up to around 200 million cubic metres per hectare under a severe outbreak. The stands are in really poor condition at the end of this. If, for some reason, the outbreaks get prolonged, you are going to sustain a lot of losses.

Another thing that the DSS allows us to do is to look at the effect of outbreaks on planned harvest levels from the landbase, and to examine how sensitive harvest levels are to losses that occur. This slide shows Crown License 9, Juniper, information that is straight out of their Management Plan.

The reddish coloured line is their softwood growing stock that is projected for 80 years out into the future. The yellow line is the budworm susceptible portion, or the spruce and fir. The blue line shows the planned sustainable harvest level, or the long-term nondeclining sustained yield. It is set by the minimum point. Then, the DSS allows us to build budworm effects on to the management plan yields and harvest levels. In this next slide, the white lines represent the management plan growing stock, and harvest levels, are straight off of the previous graph. The slide shows two defoliation levels, 20% over the protection target (60% defoliation) and 40% over the protection target (80% defoliation), in conjunction with various portions of the landbase not being protected (0, 20, 40, 60, 80, 100%). We are interested in how defoliation and area of protection affect availability of growing stock and planned harvest levels. Analysis presented for two landbases showed that planned harvest levels cannot be maintained without protection. This helps to define how much protection is required to maintain the planned harvest levels.

Now, I am going to talk about the effects of budworm outbreaks on nontimber values. In my opinion, the biggest effect of budworm outbreaks is the changes in forest composition. It is not the volume losses; it is the changes in the forest; the age class structure and the species composition that are affected by budworm outbreaks. Especially, the age class structure. Mature and overmature fir stands get converted into young fir types, in terms of age effects. In terms of species, old balsam fir gets recycled into young balsam fir. Young balsam fir types get thinned. Budworm outbreaks kill the fir out of the mixed fir-hardwood stands, and there appears to be more hardwood types. Much of southern New Brunswick is like this, because of the increase setback in (no spray) zones that was instituted in the mid 1970's. There are NBDNRE reports from 1979 and 1981 quantifying how much fir mortality resulted from that. When you look at the forest in southern New Brunswick, right now, the current species composition is strongly influenced by the 1.6 km setback zone. For example, effects on spruce-fir resulted in leaving the spruce and killing out the fir.

All the nontimber values related to species composition or age of stands are affected by budworm outbreaks. Ecologically, over the long term, spruce-fir forest ecosystems and spruce budworm form a stable and resilient system. After this natural disturbance, the species are maintained.

It is "good" for both the insects and the forest. But the question is, will budworm or man harvest the forest?

Should there be protection against budworm in nontimber priority areas? Budworm will kill the fir out of the mature coniferous forest habitat (MCFH) blocks that are required to be maintained on the landscape under provincial policy. These MCFH blocks are being maintained for pine martin and birds that require an interior coniferous forest. Deer wintering areas and riparian buffers will also be affected by budworm outbreaks. If we set aside natural conservation areas, budworm is going to affect them just as well as it affects the rest of the forest. This is something that should be debated. A policy for protection of nontimber priority areas should be put in place. In my opinion, the mature coniferous forest habitat blocks probably do warrant protection. It is difficult to find these on the current landscape, and it is also difficult to maintain them on the landscape. The forest habitat blocks are there for a certain value. I can tell you that they are not going to be there after the next budworm outbreak if something is not done about them. You might ask the question, is the current forest's species composition that we want in conservation areas satisfied? Maybe the current species composition is more of an artefact of the past historical management that has gone on, rather than what really should be there from a long-term successional standpoint.

To conclude, I am going to propose two strategic options. The first option is to better quantify budworm protection policy by forest type, where forest type includes both the forest use and the forest species composition. We need to specify how much protection, in terms of foliage retention against budworm, is necessary in mature fir stands and mature spruce stands. How much protection is necessary in immature fir stands, in silviculturally treated stands, in nontimber priority, and especially in the mature coniferous forest habitat in conservation areas. The level of cumulative defoliation by type determines yield. We know what these relationships are. We have stand growth models that can elaborate this relationship between cumulative defoliation and yields. Maybe, we should be looking at using protected and unprotected yield curves for some stand types. It seems unlikely that we can afford or deliver the type of protection that occurred in the past.

So, are we going to base our yield and our AAC projections on the assumption that protection will be similar to that which occurred in the past? We can use harvest scheduling to minimize losses in areas that we do not think are going to be protected, because of logistics or costs. There has been some discussion about the idea of pre-blocking the forest. But what areas are predictable? If the forest is so broken up into small patches, it is difficult to design blocks. Maybe, we should not be assuming that the entire forest is going to be protected. If we do, these blockings, in terms of protectable areas, are going to give good results. Maybe we can turn protection of these blocks on and off. This would be based on the cumulative defoliation level in the blocks. This would allow us to define protection levels in terms of cubic metre per hectare expectation from the landbase, instead of protecting based on a target amount of foliage that we want on the trees.

If the management plans assume protection and it does not happen, we are going to have reduced yields. We are also going to have salvage to chase the budworm and losses due to non-planned scheduling. Then, this will result in reduced long-run sustained yield in subsequent periods. We need better definitions of protection levels. These definitions should differ from the mature old forest to the young grown forest. This is because we have more expectations from the young forest. We should establish a multi-stakeholder working group that would define protection policy. This working group could also recommend protection policy, in terms of cumulative defoliation levels by forest type, by use, and by expected yields. The yield sets the amount of protection that is required.

There could be analysis of realistic protection, like scenarios. This should include likely program size for protection. The scenarios should also include the cost of protection, given today's cost, and the logistics of spraying B.t. over huge areas of forest. In 1976, almost four million hectares of New Brunswick's forests were sprayed. To do this spraying today, it would cost something of the order of 100 to 120 million dollars. Are we going to be able to come up with 100 to 120 million dollars in a single year? Unlikely, some stands are not going to be protected. We should therefore either alter their harvest schedule to try to get around the losses that will occur or alter the yield expectations and reflect this in yield curve sets.

The Decision Support System and its link with the stand growth model have already done some of the calculations that are required to do the analysis. We have defined a number of classes of stands in terms of natural stands and treated stands, the species composition of spruce fir, and age classes, (immature, mature, and overmature stands). We have produced tables of the percentage volume losses resulting from all possible levels of defoliation that would occur in these types of stands. If we have a certain cumulative level of defoliation, these tables will allow us to know how much percentage reduction yields we are going to suffer. So, we are part way there already.

The second strategic option is short-term. This short-term option is determining the effects of budworm on nontimber values. We know a lot about the effects on timber volume production. I think we can use the same modelling and Decision Support System approach to quantify the effects of outbreaks on nontimber values. Outbreaks affect the forest composition and the age class structure. Other things that could be affected are the species distribution and maybe the patch size across the landscape. There is a Greater Fundy Ecosystem Research group in the Fundy Model Forest that has defined biodiversity guidelines for the Fundy Model Forest. There is not a reason why a Decision Support System approach could not be used to calculate the effects of budworm outbreak scenarios on these guidelines. Another point I would like to mention is predicting effects on wildlife habitat, especially the Mature Coniferous Forest Habitat blocks. This is because we know that mature conifers are the most sensitive species. Habitat requirements for other species are being worked on by NB DNRE. I would also like to mention Conservation Areas. How will a species composition area be changed with or without protection? What do we want these Conservation Areas to do? Is it just going to be a set aside area where we do not care what the forest is like, or do we want these areas to represent particular types? How does that relate to budworm? Another issue is riparian zone functioning, and the woody debris effects. I suppose there would be lots of woody debris after a major budworm outbreak.

We can analyse the effect of alternative management scenarios to reduce future damage in the need for protection. In my second presentation, I will talk about the idea of forest restructuring or forest composition changes.

There is also the idea of natural disturbance as a template for forest management. This requires some thought as well. Budworm has been around for a long time. But, I do not think that the effect of budworm on the forest may have been as great in the past as it is now. This is because of the increase in fir. We have a stand growth model called STAMAN that is calibrated for budworm defoliation. This model into action can determine effects of defoliation just the same as you could put in any other factors to project stand levels.

To conclude, the next budworm outbreak is expected around the year 2000 or 2005. Nobody knows exactly what year, but it will be back for sure. The effects on forest productivity should be clear. There is no reason why it should be any different from what happened in the past. There are ramifications to the Mature Coniferous Forest Habitat areas that we are managing now. Should there be protection of the Conservation blocks? The Decision Support System that we developed allows evaluation of the consequences of no protection. This system also quantifies the benefits of alternative strategies and identifies priority areas.

I proposed two potential strategic options. The first one is defining protection policy against budworm by forest type and use. The first option is also to directly link protection expectations to management plan timber and nontimber yields. The second option is quantifying budworm and management effects on nontimber values, using a DSS approach. Thank you very much.

Louis LaPierre: Thank you very much Dr. MacLean. Are there any questions for Dr. MacLean? No questions at all. Are there any comments? If there are no comments, you can get back to Dr. MacLean when he does his second presentation. But, I have a question. Dr. MacLean, on the forest structure over time, are we going towards that now? Or, is that something that would have to be totally replanned? And, that seems to be a very long option.

Dave MacLean: It is an option over the long term. I think we can get around the budworm problem in two ways. The first way would require a breakthrough in biological control of spruce budworm. We need to import, find, or create some natural enemy that is going to cut off the budworm problem.

However, we have been trying to import parasitoids for fifty years already; I think it will be a long time before that happens, if ever. The second way to try to resolve the budworm problem by designing management options that we need to do over the long term. The aim would be to restructure forest to reduce the damage that occurs in future outbreaks. Some of the things that we have been doing in the past have been along that line. Black spruce plantations are less damaged than other spruce plantations. But, as you get too much of any particular stand type across the landbase, it gets worrisome. If it is not budworm, it is yellowheaded spruce sawfly, or it is something else that is damaging to the forest. Forest restructuring is definitely a long-term view. I will address this more in my second presentation. However, I think that if we do not get started now, in trying to determine and quantifying the effects of making some changes, then we are going to be in the same situation thirty or forty years from now, as we are right now.

Louis LaPierre: Are there any other questions? If not, thank you very much Dr. MacLean. I would like to ask the speakers who have come forward this morning and those who will come forward this afternoon, if you could prepare a paper. On this paper, I would ask you to write down your recommendations. What you want brought together as the major topics for your recommendations. For example, Dr. MacLean summarized his recommendations at the end. But Dr. MacLean presented a lot of information in his presentation. How much of this information would he want to put forward? We would like to have these papers typed this afternoon. So, we would have them for you this evening.

The next presenter is John McEwen. John McEwen is no stranger to any of us in New Brunswick. Mr. McEwen is with the Workers Investment Funds. He is working on the issues of investment and the funds of the forest workers. Mr. McEwen is going to speak to us on the socio-economic implications of the budworm from the workers perspective.

3.4 SOCIO-ECONOMIC IMPLICATIONS OF AN INSECT INFESTATION

John McEwen: Thank you very much Dr. LaPierre. I was very pleased to be asked to be here. Looking over the agenda, I think it is very important that there is someone here besides people who are totally focused from an academic point of view. I think that it is essential that we look at the impacts that decisions have on the general economy and the people that participate. The vast majority of New Brunswickers are not present here nor are they represented here. So, it is quite a challenge for me to be able to come here. I will try to give a point of view from all the people who are not represented here. I appreciated that you asked me to be here today. When I was asked to play this role, I felt quite positive about it, and quite honoured. I believe I was asked to represent all the people, because I come from the forest industry, and there is a linkage across the diverse communities. In another life, I was a paper maker and I was able to have a commonality, I believe, with the whole community. I was also fortunate a number of years ago to sit on the Premier's Round Table on Environment and Economy. I think that group of participants did a good job in representing all New Brunswickers. I feel I have a real opportunity today. And, if you give me the opportunity to expand on the agenda and take some license, I will not address solely the budworm issue. I would like to address the impacts of forestry on the general population and on the economy of New Brunswick.

A lot of presenters here have been talking about how we can take more from the forest. This is the old "give-and-take" scenario. Somebody gives and somebody else always takes. But there are two dimensions to it. There is also the investing dimension. I remember one of the MLA's calling me up about three or four months ago. He was so excited! He had the best investment that you could find in the world. It was better than BRE-X on the way up. I thought somebody would have to go and haul that person off the ceiling, he was so excited. When he finally finished the pitch to me, I said we are in the accumulation phase. We would like to have some investment so that we can do the investing. I said to him, have you purchased any shares in the Investment Fund yet? Well, at that, I thought that I would have to call 911.

Finally, there was some hyperventilating going on at the other end. When the MLA recovered, he said they really did not know much about it, but, he knew were I should put some money. So, it is give-and-take. If you do not invest, you cannot take out. Today, we are talking about how we take more out of the forestry economy of New Brunswick without putting something in. Investing in New Brunswick's forest is not wrong.

New Brunswick has been very good to us. The New Brunswick Forestry Industry has been beneficial to us in many ways. Unfortunately, there are a lot of special interest groups around. These groups are very keen on putting their voice forward and getting their views across, to become the deciding factor. I would like to tell you that coming from the forestry sector, New Brunswick's economy depends on about 40% of the forestry, if not a touch more. In some regions, especially the region where I come from, the Campbellton/Dalhousie area, the economy depends on close to 100% of the forestry. Downtown Fredericton, forestry is not 100% economy, but downtown Dalhousie it is 100% of the economy. The decisions that are made here have impacts on those areas where forestry is so important to the community.

Forestry is not popular. Decision makers in our economy think that people sitting in a back room with a telephone close to their ear is high tech. These people also think that this is the leading edge, where we should be at. Historians and economists tell you to build on your strengths. The strength in this province is forestry. The forestry industry has provided many economic benefits, far beyond good jobs. Forestry has provided good education for children. It has also provided a good standard of living, not only for the people that work there, but for other people in the community, because there was so much interaction. The forestry worker works in the paper mill, pulp mill or saw mill. Then, he goes down the street, buys postage stamps, rents videos or buys a pizza. We also have some good recreation opportunities in the forest. There is hunting, fishing, camping, and variations of them. Because of forestry, we have also created some good transportation systems in this province. And, because of forestry alone, we have good roads. In the past, they drove into the rivers to transport the forest material. Today, because we transport materials and fibre to the mills on roads, we have to have better roads. We all enjoy better roads.

Almost all of New Brunswickers have benefited from forestry. Forestry has been the unsung economic developer of the province of New Brunswick for many years. But, forestry has been ignored at the peril of the future of the economy. We have all benefited from the forestry in one way or another. Because of the economy that developed out of the forestry, we had a better tax base. But now there is not a lot of slack left in the system for misguided judgements and for decision-making that reflect solely the interest of special interest groups.

I would like to speak from my own area where there is Crown land. We used to have what we call lost land, up in Campbellton/Dalhousie area. People used to go on that land and cut the trees. Nobody knew it was Crown land or private land. Then somebody went on the land and found out exactly where the Crown land was. The next year, they stopped the people who once cut in that area, because they now knew exactly where the Crown land was. Then, we had some problems. The MLA, at the time, had to correct these problems. We also have a spray program. When the soft woods grow, we want to kill all the hardwoods. We are going to kill all the hardwoods in the Restigouche area. But, suddenly, someone found out that birds eye maple was very valuable. So, some of the people went back to the land to cut the birds eye maple, because, they were going to spray the birds eye maple the year after to kill the hardwoods, so that the softwoods would grow.

Suddenly, all their equipments were seized. Then, they went to court. That created another interesting dynamic in the Restigouche area. We also made a decision to gut the Crown Lands and Forestry Act. We are still feeling the ramifications of that decision. Instead of making adjustments and making an effort, maybe they had to change it in order to bring it back where it should be. Once they gutted the Crown Land Act, nobody made the effort to make the changes that were necessary. These changes include having to put in place a comprehensive plan that would allow for the sustainable harvesting of fibre and of forestry in those areas of the province where forestry is so important. We also made a decision about seniors, that they were going to have to pay their own way. There are more seventy-year-old people in this province that own woodlots than there are twenty-seven-year old people.

I manage an estate for my brother; I can get his woodlot cut under the table. It is not a problem. The seniors want the cash and the government is not going to get it from the seniors who are on the verge of going into a senior citizen's home. So, we flooded the market at that point in time. We cut our future supplies. That was the decision that was made by the government, thinking they would make things a lot better.

A number of years ago, the government saw that the deer hunting population was being reduced in my area. So, the government said they were going to put a moratorium on to allow the deer to come back. According to outfitters in the area, life as we know it today would no longer exist in New Brunswick if that moratorium went into place. The politicians were forced to give in. Many times, I would never want to be a politician, and this was one of those times. They had intense pressure on them. But, I would ask the same outfitters in those areas now, what is going on? Because, there are no deer left in Northern New Brunswick. Did life change? Did you notice it?

I think that budworm is one part of the panic and the stampeding that is going on at this time. If the fear and the stampeding are starting today, maybe it has already started; we have to be very careful that decisions that could create the wrong or the inappropriate result are not being made. We depend too much on the forest. The area where I come from, the Campbellton/Dalhousie area, depends almost totally on the forest. The people who live in that area are more closely attuned with the forest than the people who live in Fredericton are. This is because people from Dalhousie live it and breathe it, everyday. If these people want to go hunting, fishing or for other enjoyments, they are five minutes away from the forest. They know what is going on in the forest. They do not want the spraying tactics that were used in the past. I can assure you that the spraying will not happen, because these people will not allow it to happen. Although, people realize that the forest has to be protected, they do not want a cookie cutter approach. In the past, the spray service seemed cheap. This spray service provided the province of New Brunswick with almost a Third World status as the dumping ground for every dirty chemical that was produced in Canada but that could not be sold anywhere else in Canada. When people from Dalhousie went back to their camps, they saw little notices saying do not eat the berries.

These people realized that the animals could not read. Again, people also tell us do not eat the liver of the animals. It is important that you realize that the spraying is not going to happen again. Do not consider that laissez faire or easy to do type of approach. I think there has to be a whole lot of effort made in other ways that will provide alternative means of controlling the budworm.

We want to keep our jobs. We want the forest to be protected, but we do not want to poison the forest. Please listen closely! We just saw what happened with that MAI (Multilateral Agreement on Investment). That investment concept was destroyed by the Web. New Brunswick is the highest user of the Internet on a per capita base of any other province in Canada. People will use the Net and they will go to your consumers. We know what happens when they do that. Please do not consider using the same tactics as in the past. The economic implications are enormous. If we have any major negative change in wood supply, then the decision-makers, the government, and other special interest groups must proceed carefully. There is very little slack in the forestry system. We have allowed more mills and more sawmills. There is not much accommodation for any major negative impact. We cannot be seen eating our seed corn. The government and decision-makers have to be very careful. They cannot make decisions that will increase fear among woodlot owners. The government says that at a certain age, you better do something. So, people did it, like woodlot owners. Having messed up the seniors' situation, the government proceeded to redouble their efforts. They saw people doing all this cutting in the woods, so they threaten them with legislation. So, you are going to threaten private woodlot owners with legislation and that is going to teach them a lesson? Last year, between here and Campbellton, the number of new roads that were driven off the main roads into the forest were incredible. People are going to cash in. The government is threatening the people by telling them that if they do not smarten up, they are going to do something legislatively to them. This is not going to happen. The government will not have this opportunity. Like I mentioned earlier, having messed up on the seniors' situation, the government redoubled its efforts and made it even more difficult for people to use any reasonable when they develop their woodlots. This is like the European adage that says, "beatings shall continue until moral improves." So, let's be careful.

The other issue that I would like to mention is on defining the problem. We spend so much time defining the problem that we almost sound like we have the solution. Many people fall into this situation. We have to wake each other up and ask ourselves "is this defining or providing a solution?" We have become experts at defining the problem. You have symposiums all throughout New Brunswick that spends all their time on defining.

In the meantime, we have a lot a Natives cutting wood. Somebody better deal with the problem, not define it. If this conference is a definition of how big the budworm is going to be and defining other issues, we have to have solutions. It is heartwarming to see that there is going to be an honest attempt at providing some solutions, starting tomorrow. One of the solutions that is capable of making a difference is, for example, to rebuild a regulatory and legislative court proof framework. This framework could provide sustainable and productive uses of the forest, and it could take today's factors into account. The Marketing Board approach, that was the underpinning of the last Act, is not appropriate. We cannot be developing legislation that give one of the stakeholders or one of the special interest groups special legislation or special economic benefits.

Even though, I am a woodlot owner myself. If we are going to develop legislation for the province of New Brunswick, we have to develop the legislative and the regulatory mechanisms that will provide an enhancement of the forest. This will encourage woodlot owners to develop their woodlots better and more appropriately. At the end of the day, all New Brunswickers and the economy of New Brunswick will benefit from that kind of reasoned approach. I want to make sure that you do not think that I am talking about a Market Board type approach. I am talking about looking after the economy of New Brunswick. And, the economy of New Brunswick overrides all the special interest groups in this province.

The social economic impact in decisions must be made in direct consultation with economic players as to where and when they would be impacted. For example, and referring back to the seniors care changes, you sell your house, you sell your farm, but you do not sell your woodlot. You are going to cut it.

I think you have to be very careful when you look at sustaining the soft wood sawmills. You also have to be careful for the people who use the softwood, and who consider doing a hardwood mill. Hardwood is just as valuable as softwood in many ways.

When people are making decisions, the natural gas pipeline is another factor to consider. We cannot allow the politicians and those who are in charge to allow the natural gas pipeline not to reach Northern New Brunswick.

What do those mills, saw mills, paper mills, and pulp mills do in Northern New Brunswick to be able to compete evenly and appropriately with the mills that have the natural gas pipeline? Those decisions cannot be made in isolation by a few people listening to a few others or by people that are skilled at advocating in the best interest of the people who hire them. The decision-makers have to make decisions based on what is best for New Brunswickers. If you do not allow the natural gas pipeline into the North of New Brunswick, you are telling the Northern people that they are not going to be allowed to be competitive with yourselves nor with our friends and neighbours in the United States.

The government can be the initiator, but not the major player in the decision process. Special interest groups should have the ear of the government on the same bases as the other socioeconomic players. The government players must be seen as making decisions for the common good. I have been through a number of exercises where we have tried a reasoned approach. In my other life, involved with trade union movements, my counterparts and I developed a new way to do the compensation, health and safety system in New Brunswick. We had the Chair of the Compensation Board maneuver and manipulate something that was not appropriate and the Minister allowed it to happen. The two key players who made a reasoned approach were not necessarily ignored, but they had to go through a struggle to achieve a reasoned approach. This reasoned approach was set aside. Today, we have a system that continues to be less than adequate. I think both sides would agree on that.

So, I will leave you with this thought. Having had all those types of experiences, we can have all the wonderful and beautiful things said here today. We can make good decisions and we can go out and have good results. I will leave it to one thought and that is that for every mile of road there is two miles of ditch, and the struggle is to keep it between the ditches. Thank you very much.

Louis LaPierre: Thank you very much Mr. McEwen. Does anyone have any questions for Mr. McEwen?

Blake Brunsdon: Mr. McEwen, you have cautioned us against a misguided judgement or making decisions where we have not taken in the wishes of the majority of the people. You have spoken about the dilemma of average New Brunswickers being very concerned about not reducing the available wood supply. You have also spoken about the economic importance of forestry, but at the same time, you have been adamant in saying that you want to avoid the spraying of the past. My questions to you are what advice would you give us on how to poll? How do we find out what every person in New Brunswick or the vast majority of New Brunswickers want? How do people think we should deal with this specific problem we are talking about today? That is, maintaining the economic viability of the forest industry, while at the same time minimizing or eliminating the use of spraying?

John McEwen: This is a difficult question for me to answer. I do not know if anybody in the room has the complete answer. I remember back in the 1970's, many of us were advocating the use of B.t. At the time, there were a lot of people saying things, like this product will never work or it only works on one tree at a time. Now, people are accepting that B.t. does work. This product is very expensive though. I think we are going in the right direction. I think we are going towards a very reasoned approach to how to deal with these issues. I think the real concerns, of everybody in this room, are to try to find the best strategy to reduce budworm outbreaks. We want to be able to progress and do a better job. In the last couple of years, they are talking about a change in the approach to cancer treatment. This change seems to produce tremendous results. People are quite excited about this approach.

I think that this has been done, because people took an aggressive or a progressive approach. The problems we had in the 1970's have created a certain climate or atmosphere. People want to take a more progressive and aggressive approach and they want to look at the genetics of it. We are cloning animals now, so surely we can find the solution to the budworm problem. Maybe, we cannot find the solution through total eradication, because that is very expensive. But, we could find the solution through control. How do we control it? How do you make sure that an individual with a small woodlot has in place the right forestry practices? We have to make sure that forestry practices do not encourage or create the opportunity for an outbreak or that they do not assist an outbreak.

I suppose that you do not have any of those tools at hand, right now. Those tools are very simple tools to put in place. That is why I suggested a revisit to the Crown Lands Act. I also suggested expanding the Crown Lands Act, and looking at it from an economic forestry point of view, not just from the woodlot owners' point of view. Because, the woodlot owner wants to have the best advantage and the best price for the wood. That is all right. But, our focus in New Brunswick should not be in providing economic advantage for one or two groups of people. I think we have to look at the full economy. Part of it is to take that type of approach, go revisit the Crown Lands Act.

Louis LaPierre: Thank you very much Mr. McEwen. As I indicated earlier, we will have more questions for you this evening. There seems to be some interesting points brought up that will certainly make an interesting debate tomorrow.

The next presenter is Dave MacLean. Dr. MacLean is going to speak to us on the ecological integrity in forest protection. Dr. MacLean mentioned this in his first presentation. I suppose Dave is going to move us towards the long-term planning of the forest.

3.5 ECOLOGICAL INTEGRITY AND FOREST PROTECTION

Dave MacLean: Thank you very much Dr. LaPierre. The title of my presentation could be interpreted in different ways, by different people. I wrote a subtitle to give you an indication on the direction that I am going to take. The subtitle is *The Role of Forest Composition and Budworm Management*. Rather than looking at the environmental effects of protection, I want to look at the ecological role of budworm and where it fits into the ecosystem. I am going to touch briefly on the role of forest management as a component of Integrated Forest Pest Management. I will talk about the relationship between budworm- caused mortality and stand characteristics. I will discuss the ecological functioning of spruce-fir forest and the implications of forest composition to budworm control. What do we know and what don't we know? Finally, I am going to propose one potential strategic option.

The basic idea of Integrated Pest Management is to use a variety of techniques to reduce losses to pests. Inherent to this is the desire to lessen the reliance on insecticides and pesticides. It is usually thought that we can include silviculture and forest management to the detriment of pests. But, do we really know how? The scale of operations in the forests of Canada indicates that we should know what we are doing in this regard. In 1991, about 2.2 million hectares of forests in Canada were either planted, site prepared, tended or harvested. This is one-half percent per year, so over a fifty-year period, at this rate, we would be affecting 25 % of the forest in Canada. I suspect that the rate is higher in some regions, like New Brunswick where I think we are up to treating about half of the forest. If this is the case, we should know what is the influence of these treatments. Are we doing better or are we doing worse?

In the 1920's, there was a scientist named Craighead who worked in New Brunswick. This scientist stated that "the prevention of a recurrence of economically damaging populations of the spruce budworm is purely a question of forest management. Conditions must be developed that are least favorable to the enormous multiplication of this insect and that are least susceptible to injury. Then, the outbreaks can be rendered much less potent, and the losses can be reduced to a minimum."

This sounds pretty good. Here we are 74 years later, what do we really know? What is the reality versus the myth of the role of silviculture or forest management in Integrated Forest Pest Management?

This boils down to whether specific silvicultural tactics are prescribed. Are the effects of these tactics on future insect outbreak dynamics and impacts known? The short answer to this is that we do not know as much as we should know. However, we know that there are differences in levels of mortality associated with maturity and with tree species. We also have some indications of some other things that happen. Increasing hardwood content in stands has been observed to reduce mortality of balsam fir. It is not just because balsam fir is not there anymore; stands with greater than 20% hardwood have been observed to sustain about 20% less balsam fir mortality. A specific study in Maine indicated that stands with greater than 35% hardwood had 40% less balsam fir mortality and 16% less spruce mortality. More recently, we did a study at UNB, where Ted Needham and I supervised a graduate student, Qiong Su. Mr. Su looked at the effect of hardwood content on defoliation of balsam fir. This student selected twenty-five stands in northern New Brunswick, based on hardwood and fir content (5 with 0-20% fir, 5 with 21-40% fir, etc.), all of the same soil and site type. Branches were cut from the trees, and the amount of defoliation of balsam fir was measured for five different years, from 1989 to 1993. In all these cases, there was a strong declining relationship of less defoliation of balsam fir when there was more hardwood in the stand. In this next slide, the same data was presented in another way, as a trend over time. In 1993, the outbreak was declining in all stands, because parasitoids and diseases were catching up with the populations and causing decline. However, stands with more than 40% hardwood had substantially less defoliation in all years. The hypothesis of what is going on relates to Eldon's diagram with all the little boxes. These little boxes include additional species, higher diversity of tree species, higher diversity of natural enemies and an earlier decline in the outbreak. One thing that we do not know is whether the effect of hardwood would be as strong earlier in the outbreak, when you would expect the action of parasites and diseases to be less. But, there is an indication of part of a strategy that should be looked at.

There has also been data out of Québec indicating that soil drainage affects the amount of mortality of balsam fir. Very dry sites, xeric, and very wet sites, hydric, sustain about 70% to 80% mortality. More mesic sites, where perhaps balsam fir is better able to grow, sustain much lower mortality of balsam fir, like 20% to 40% mortality in a moderate outbreak. There are similar data for black spruce from Maine. On the very dry sites, black spruce had 35% to 50% mortality, versus on the poorly drained sites, where we might expect the black spruce to grow better with only 11% to 25% mortality. This is another factor that should be looked at. Maybe, we should be looking at what species we have on what sites.

If we want to create a strategy, we have to consider the issue of effects of outbreak dynamics that Eldon mentioned. We have seen repeated outbreaks beginning about 1910, 1940, and 1970. Populations oscillate in synchrony, regardless of levels of damage to the host. Outbreak collapses are caused by parasites and diseases.

So, if in the long run, budworm will come and go independently of what is done to the forest, the major effects of silviculture should be to buffer stands against these periodic episodes. If we can influence the natural enemies of the budworm as well, it is for all the better.

The silvicultural goal for budworm management is maintaining vigorous stands with rapid growth rates. This enables the trees to better withstand or recover from defoliation. Another silvicultural goal for budworm management is increasing spruce or nonhost content and getting rid of balsam fir at an early age. I would like to caution the effects of vigorous stand growth rates; the trees may be better off, but they are not immune. On this slide, we can see dead trees in young silvicultural treated (thinned) stands from Cape Breton Island. These trees were twenty years old or so, and Harold Piene has quantified the response of trees to the silvicultural treatment. There was over 90% mortality in young silvicultural treated stands, because there was a concentration of budworm in one particular area. The budworm fed so heavily, that they stripped the trees in two years, of both the current year's foliage and all older foliage. Now, these trees were very vigorous and growing well at the start of the outbreak. Mr. Piene established two plots where he started spraying two years in.

There was almost no foliage on the trees, but they came back beautifully. There was no mortality of trees at all. You have a choice. Either you use no protection at all and maybe 40% of the crop trees and your investment, or you put some protection in the forest. We can prevent the mortality that is occurring.

What about uneven-age silviculture? Where does this fit in budworm management? Uneven-age silviculture would reduce the vulnerability or level of mortality, but only if balsam fir were selected out. It would also maintain a continuous open cover of mature trees, which is great for budworm. Every ten years, light partial harvest would help to remove balsam fir. There are also some possibilities of precommercial thinning in red spruce-fir or in hardwood-fir types, if the precommercial thinning is done to remove the fir and get rid of them as much as possible. Therefore, uneven-aged silviculture is clearly not the whole answer to the problem of budworm.

Long-term regional management strategies get more problematic. What has usually been recommended is that we maximize the between-stand diversity of the age classes of stands and of vulnerable and nonvulnerable stands? It also has been recommended that we attain a regulated sustained yield forest, and that we ensure that site preparation and planting programs used nonhost species. Obviously, if it is not a host, it is not going to be affected. The real effect of levels of manipulation of the forest, in terms of the effect on outbreaks, is not known. We really do not know, because we do not know what the effects of outbreaks are. It has never really been addressed and it has never really been studied. We see these recommendations to reduce effects of outbreaks going back years and years, but nobody can quantify how much good it would do. Nobody is going to implement these forest-level recommendations, because it would be a lot of work and have major costs.

Removing balsam fir in whole stands, and selection within stands, makes sense. It is essential to use protection to maintain the wood supply and the age class distribution. I think the use of B.t. is much less contentious now, than previous materials.

Next, I am going to discuss the issues of budworm, the ecological functioning of spruce fir, and the cyclical succession of fir replacing fir. If we start with a mature healthy fir forest with advanced regeneration underneath it, when budworm outbreaks happen, the stand is defoliated and much of the over story is killed. But, much of the regeneration survives. We then get a young forest, derived from the regeneration with a few remnants of the old forest. This young forest is often extremely dense. It benefits from a precommercial thinning to increase the growth rates. Eventually, we end up with a new mature and healthy forest. So, budworm is a part of this ecosystem.

The effects of forest structure on budworm dynamics include three factors. First, is the effect of diversity of tree species on the population levels of natural enemies? Secondly, the structure of the forest will determine the deposit of insecticides during protection. There have been indications from studies done by Ed Kettela and Eldon Eveleigh that there is better deposit in thinned stands. The insecticides get down lower in the crown and you get better protection. Finally, the third element is a tree vigour effect. I believe that the ability to withstand and recover from defoliation is stronger in vigorous stands. But, keep in mind that tree vigour is not the answer by itself. These elements help to define prescriptions relating to forest structure. However, these three modes of response are not sufficiently defined or well understood. We need to know and quantify the effects of these factors on budworm outbreak duration and intensity. We also need to know the effects of these elements on tree response.

There are indications that the natural enemies and tree vigour modes of action could play a valuable role in Integrated Forest Pest Management. We need prescriptions defined in terms of what and where, and we need quantitative results from those prescriptions. If we do not have quantitative results, we are never going to be able to convince anybody to spend the money on the scale of treatments that are required to change forests over large areas. This convincing can be achieved by developing the best scenarios, by looking at all the factors, and by looking at the indications that are there in the literature. The convincing of the use of the treatments can also be done by doing some modelling, brainstorming including different stakeholders, and by coming up with a set of ideas of things that might work.

Then, we need to conduct experimental treatments to test these hypotheses. Treatments can either be conducted by locating areas that already exist in the landscape or by creating areas, if they do not exist. And then, it will be necessary to monitor and study effects of stand and forest factors (hypotheses) on the insect populations and on the tree response during the next outbreak. This is a long-term approach and a long-term view. But, I think if we do not take these steps, we are going to be stuck forever with this 1924 statement that makes eminent sense, but we do not know how to do it.

About five years ago, there was a scientific paper published by two scientists named Miller and Rusnock entitled "The rise and fall of the silvicultural hypotheses in budworm management". The silvicultural hypothesis in this paper was that damage caused by budworm was largely due to the disruption of natural ecosystems by forestry practices. The silvicultural hypotheses also stated that damage could be significantly reduced by appropriate forest management and silviculture. Miller and Rusnock concluded that in later years this silvicultural hypothesis was widely rejected. They concluded that this hypotheses was based on false assumptions, and that because these assumptions are relatively impervious to factual information, the debate may not be resolvable by reference to additional scientific information. Miller and Rusnock were trying to say that the logistics of a test of a large-scale forest manipulation that could reduce the damage of budworm outbreak were so large and costly that we have never seen this done and we may never ever see it done. The development and implementation of this type of test would cost a lot. Nobody is willing to develop this test, unless they have some indication that it will work. Think of creating checkerboard of different stand types, young and old, susceptible and nonsusceptible, over a whole forest License of several hundred thousand hectares.

There is also the element that you hear repeated sometimes, that if we manage our forest correctly, there would not be a budworm problem. In my view, this statement is wrong. The only "problem" here is that we are competing with budworm for the timber. There is really no budworm "problem" at all. Budworm outbreaks are part of ecological functioning. We know that since the 1700's, there have been a number of budworm outbreaks, around seven or nine.

The average cycles of budworm are in thirty-five to forty years. The budworm and spruce-fir form an interdependent cyclic successional pattern and a natural disturbance that is ecologically resilient and stable, but it is economically unstable. There is more fir today and that makes the outbreak larger and more damaging. I would say, let us forget about preventing outbreaks until we have some kind of biological control breakthrough. However, I think we can do better in managing the damage that will occur in the future. Current budworm population dynamic theory indicates that budworm comes and goes regardless of the forest. This theory also indicates that it is impossible to prevent outbreaks. But, the vulnerability of different stand types is well documented. We can alter the mix of stands with different vulnerability and this will sustain different amounts of mortality on the landscape. We can also conduct forest level management to minimize the damage that will occur. Our measure would be the cubic metres of timber lost under management regime A versus management regime B. It is really no different than setting a sustainable harvest level for a landscape. It would use the same type of forest management planning and timber supply planning procedures.

We could ask the question, is changing the forest structure for budworm control compatible with biodiversity goals? More and more natural disturbance is being touted as the template for forest management actions. The idea here is that we would manage stand types by treatments that would mimic the natural disturbance regime. This would be done either by a stand-replacing regime that would emulate fire or a major budworm outbreak, versus by a gap-replacing regime, that might result from natural mortality in stands or a minor budworm outbreak. Therefore, stand replacing would mimic a whole stand burning or getting killed off by budworm, like mature fir; gap replacing would mimic individual trees that are dying creating gaps and new trees growing up in the gap.

We should also consider that the present forest might not be the desired objective. We need to set explicit goals for what kind of forest composition we want in the future. The forest now, may not be "natural". It has had 300 years or more of activities going on in it. For example, fire protection activities. I think that there is a lot more fir in the forest than there used to be. Other analyses that Judy Loo and others have done have also indicated that.

Our forest composition goals should be influenced by the historic composition and disturbance dynamics of the forest, but they should also be influenced by the values, the products and the expectations for that forest. There should be a conscious choice from the stakeholders to determine what kind of forest they want in the future. In my opinion, by restructuring the forest to reduce some budworm damage, we are not going to eliminate budworm. We are not going to eliminate the stand types that are cycled by budworm. I think it is compatible and we should be moving in that direction.

The Spruce Budworm Decision Support System (DSS), being able to do some projections about the effects of management actions over large areas of forest will help us move in this direction. This system is a forest level-planning tool that is similar to a timber supply model. It includes GIS, a budworm population model, and a stand impact model. People are working towards a vulnerability rating system and a forest inventory projection system. These people are my colleagues at CFS, Kevin Porter, Wayne MacKinnon, and Kathy Beaton, and some FPL employees, Gerry Cormier and Shawn Morehouse. The real value of the DSS is showing what is the forest-level outcome of forest management tactics at the stand level.

Planting, thinning and selection or shelterwood silviculture, where do they fit in? We can identify certain types of species site-matching that are most damaged, and ensure that their occurrence is minimized. At the forest level, protection is one of the strategic options that are available. Harvest scheduling is another strategic option. Altering the species composition, the age class distribution, and the spatial pattern are other options. It is pretty complicated; it is almost as bad as Eldon Eveleigh's diagram with all the little boxes of the parasitoids, hyperparasitoids, other host species, etc.

We did a little bit of playing around with this approach on a small scale, of looking at what would be the possible quantitative effects of a silviculture and forest management scenario. We took a 32 000 ha portion of the Fundy Model Forest in southern New Brunswick, and looked at the current forest composition.

And we said, what if we were using the soil drainage mortality effect mentioned earlier. We identified the spruce-fir stand types that are on hydric and xeric sites, that is on wet and dry sites. We are hypothetically directly harvesting toward them, followed by planting black spruce and jack pine on the very wet and very dry spruce-fir sites. We would put the black spruce on the wet sites, and the jack pine on the dry sites. We would do this for the spruce fir stands and for the mixed spruce-fir hardwood. But, this is just a "what if?" By harvesting 50% of these stands over a ten-year period, we would reduce the losses in the next budworm outbreak by about 250 000 cubic metres. This would amount to harvesting 19% of the area, which would be excessive. Ideally, we would use a combination of protection on some of the area, and redirection of harvesting and silviculture on some of the other area. Just to show the effect of the scenarios, this slide shows the spruce-fir volume for the whole 32 000 hectare area. This is in ten-year intervals, from 1994 to 2004 to 2014 to 2024. The different colours represent the spruce-fir volume in different stand types, in spruce-fir, mixed spruce-fir hardwood, and in hardwood stands. Protected means that we have sprayed every year during a budworm outbreak, using B.t. to keep 60% of the foliage on the tree. Under the protected scenario, the forest is pretty static, and volume actually increases a bit. Unprotected means that we have not sprayed at all, resulting in the loss of 380 000 cubic metres from the forest, because of the mortality and the growth loss that goes on.

Under the silviculture/forest management scenario, there is no protection at all, but there is direction of harvesting and planting towards types that are seen as the most damaged.

My single strategic option for this topic is a big one and it is a long-term one. It is testing forest composition treatments that have a strong possibility of reducing budworm damage. To progress beyond Craighead's 1924 generalities, we need plausible hypotheses in place before the next outbreak. We need tests to determine their role in an overall strategic plan. I would like to see a working group established, to select the forest composition factors that are most likely to reduce budworm damage. This should be a multi-disciplinary group involving industry, NB DNRE, and researchers. One idea is that hardwood/conifer mixtures to enhance natural enemies have a role to play.

What about the idea of host stands next to nonhost stands? Will this reduce the amount of eggs that are laid? Will it reduce the damage that occurs? Where does increased vigour to better withstand and recover from defoliation fit in the strategy? How does that have to be linked with protection? What is the actual mechanism involved in the reduced damage of black spruce? Can we transfer that to other species?

In some calibration work in the STAMAN model, we found that when black spruce is defoliated a given amount, you get exactly the same growth reduction on black spruce as you do for white spruce and balsam fir. Survival is better, however. What we do not know, is whether there is less defoliation occurring in black spruce stands, as well. And what is the role of stand structure and forest configuration? I suspect that a lot of the treatments that we would need to study these things are already out there on the landscape. They just need to be located. We need to put in place some monitoring and measurement system in the treatments. In some cases, though, we may need to establish stands or forest, to determine the effects of some of these factors that are selected. It needs careful design. Some factors would cover large areas and other factors would cover small areas. This needs to be in place before the next budworm outbreak. Then, we need to study the effects of these factors on budworm populations and on impacts throughout the next outbreak. The objective would be to define workable planning strategies and best management practices for implementation.

The relationships must be quantified in terms of the effects on AAC, on dollars and jobs, and on reduced insecticide use.

I view that a multi-agency project is the only way this would work. With structured roles, and defining the projects and treatments, everybody would be involved with this project. Locating the existing treatments or implementing new treatments would involve primarily, industry and the NB Department of Natural Resources and Energy. The monitoring and manipulative experiments would involve the Canadian Forest Service and university researchers.

There is a possible avenue for funding of such a project. I think Eldon mentioned that once you have got some money from the industry or the government, there is a program in place nationally, NSERC University-Industry, that will take those dollars and triple them.

In conclusion, spruce budworm is a natural part of the spruce-fir ecosystem. But, the problem here, is who will harvest, budworm or humans? We cannot prevent outbreaks. But, I think that we can manage the damage that occurs. And, I think we can do better, and that we will have to do better in these areas. We cannot afford to protect the forest the same way we protected it in the past; it will just cost too much. We need to determine the mechanisms of vulnerability and budworm response for stands and forest factors, and get on the ground to put tests in place. What I have proposed as a strategic option is to test the role of forest composition in reducing spruce budworm over the long term. Thank you very much.

Louis LaPierre: Thank you very much Dr. MacLean. Are there any questions for Dr. MacLean?

Max Cater : I do not have a question about Dr. MacLean's presentation. And, I do not have any criticism of his presentation either, but I would like to quantify the fact that we have a dilemma that cannot come to grips with what you are suggesting, in the short run. So, we have to have some other things, some other tools. That is what I wanted to say David. It is not to criticize your paper at all. Thank you.

Dave MacLean: Thank you Max. Yes, I agree entirely that there is no way that this is going to provide any kind of answers over the short term. But, on the other hand, 1.6% harvesting per year, over fifty years, is a substantial portion of the province that we are doing something to, so hopefully we can at least start moving in the right direction. I do not think we know what is the right direction. We have some indications for parts of it. But, we have to get something underway or else we will go through the whole next outbreak. And, in thirty years from now, there will be another set of people sitting in this room, or some other room, asking what are we going to do over the long term? So, I think we have to get off the mark and try to find out some other things.

I think protection is going to be required over the long term, unless there is some kind of breakthrough. But, there are some other things that we should be trying to do as well.

Louis LaPierre: Are there any additional questions, comments? Yes.

Unidentified: David, you did not mention it, but do you give any weight to the possibility of finding trees that are more resistant than the average, through tree improvement programs. Introducing that as a factor because Bruce Zobel tells us that in South America they have done that with ants. Where they had an ant problem. They have found trees that are resistant and set out a program based on those. What do you think the opportunities are here?

Dave MacLean: There may be some opportunities. It has been tried and it has not worked too well with spruce budworm. I know this, going through old records of research by George McGillivray who worked at our lab years ago in the 1950's. At the start of that outbreak, in Green River, he selected some trees that he observed to sustain less defoliation in the early stages of an outbreak. But then, as the budworm outbreak got bigger and the population levels higher, he found that those trees were kind of "swamped" and damaged as well. There are certainly other pest problems across Canada where there is a genetic component. Dan Quiring's work with spruce budmoth here, where there is a genetic component, and it is a big thing with spruce weevil on spruce in B.C., where they are actually doing selection based on differential susceptibility. Perhaps budworm is enough of a generalist to circumvent this approach.

It seems that the populations get so high during the outbreaks, which it kind of "swamps" or overrides the effect that is there. It is worth looking at. But, I do not know unless you get into biotech or incorporating the B.t. gene into the tree, which kind of has its own problems in terms of implementation. It is worth while keeping to look at that type of thing. But, I guess I would not be too hopeful over the short term.

Louis LaPierre: Thank you very much, Dr. MacLean. I guess this brings us to a close for this morning's presentation. Just to add, maybe, a comment to Max's question. I think that throughout the day, we will see other options of where we are going. And, hopefully, tomorrow, we can discuss some of these. However, I think that Dave's last comment or one of his last comments brought some concerns to me. We have been at the forest for a long time and if we have not any management options in place or very limited management options, then our knowledge does not seem that great. I think it begs us to get to work. Because future generations, they depend upon us. If we do not put in place these structures that are needed to insure that the forest is maintained for them, I think we have that responsibility. So, I think one of the reasons we are here is to try to put a start to it. With that, lunch will be served outdoors, not outdoors but just outside the doors here. And, we will try to get back at one o'clock. The presenter at that time will be Wendy Sexsmith.

Louis LaPierre: We will start the afternoon session. It is a pleasure for us to welcome Wendy Sexsmith back to New Brunswick. Wendy certainly knows the New Brunswick scene. She was here during the budworm activities and certainly knows what the discussion is all about. But now, she has graduated and gone on to bigger things in Ottawa. But, I think she is pleased to be back here. So, Wendy, we are pleased that you were able to come and take time from your busy schedule to be here with us today. Wendy is going to speak to us on the federal regulatory aspect of the environmental protection and insecticide applications.

3.6 OVERVIEW OF THE FEDERAL PESTICIDE REGISTRATION SYSTEM

Wendy Sexsmith: Thank you very much Dr. LaPierre. I guess since I spent fifteen years of my life in New Brunswick, it is always nice when somebody invites me back. I really appreciate it and I am pleased to be here. Today, I will provide an overview of the federal pesticide regulatory system. I will not really go into detail, but just give a good overview of where we came from, what we are, what we do, and the implications potentially for the forest industry and environmental and health protection. I am going to approach it like this.

First, I will give a little background. Then, I am going to try to hit the highlights of the way we do things, which is terribly important to us in Canada and to the forest industry. As a new agency, it is a new area that we are very focused on, which is sustainable pest management. Finally, I will touch on some other issues, and then I will summarize. You can see, in Ottawa, we are pretty low tech. This morning, everybody had Power Point. I am sorry, but these were just hot off the press, like half an hour before I got on the plane.

Just to give you some background, over the years, and certainly in the 1980's, there were a lot of concerns by the stakeholders about the way the regulatory system operated. In 1989 and 1990, there was a Pesticide Registration Review that was set in place by the Minister of Agriculture. There were also recommendations made and there were a couple of things that happened after that. Again, the government looked at the whole issue and decided that setting up a single agency for the regulation of pesticides in Canada was the way to go. Actually, it was one of the recommendations coming out of the original review. The combination of that was that in 1995 the Pest Management Regulatory Agency was established under the Minister of Health. Essentially, we reside within the Department of Health. As of April 1995, all resources and activities related to assessment and regulation of pest control products in the various departments were consolidated under the Minister of Health. That included the pieces in Health Canada, Agriculture and Agri-Food Canada, Environment Canada, and Natural Resources Canada. That was a substantial change in the way the system was going to run. Essentially, the job at the federal level is to register and regulate. We look at the acceptable risk for pest control products and make a decision to register or not. Then, the provinces can use those products. They can add rules to those products. That is the federal- provincial relationship. We are very tightly linked.

The mandate of the Agency is to protect health and the environment by minimizing the risks associated with pesticides while enabling access to pest management tools, namely pest control products and sustainable pest management strategies. There is a federal Pest Control Products Act that lays out our responsibilities in the area of pesticide regulation in Canada. These responsibilities are broken down into four parts.

First, these days, our responsibility is access to new products. Second, it is looking at reevaluation or other approaches to existing registered products. Our third responsibility is that we have a compliance arm all across Canada. We do the follow up activities if there are issues. Finally, a new component of pesticide regulation is looking to support more sustainable pest management practices and to look at ways to integrate the whole concept of sustainability into the decision-making process.

The major objectives of the Agency are to protect health, safety and the environment; support the competitiveness in all the various sectors in Canada that use pest control products, including agriculture, forestry, other resources sectors and manufacturing; regulate cost-effectively in an open and transparent manner allowing everybody to try to understand how we regulate. Later, I will bring this forward as one of the two key challenges. The final major objective is the whole issue of supporting the integration of pest management with broader goals of environmental sustainability within our regulatory approach.

For those of you who are interested, we were located all over the place in Ottawa and since 1996, we are all under one roof. We do have a Web site and this may or may not be useful, but we try to put up as much information as we produce on that site like regulatory documents, updates, basic information and new registrations. If you are interested, you can take note of the address. I said that I would talk about what we are doing internally. That will include this full regulatory process. When we were set up in 1995, we inherited a thousand products from the old system that had not been registered or had not been dealt with in any way. We hope to go through a complete backlog this Fall. In past years, another big change that we made through the whole system is that registrants or the companies who produce the data to support a registration, used to be able to send a piece here and a piece there.

For those of you who do not really appreciate the size of the data package, it can fill a room in some cases, so it is quite voluminous. But when we got a piece in, we could only review that piece and we could never make a decision.

What we have put in place now is what we call screening. Only data packages or submissions from the company will be let into the system if they are complete. That means they have to meet all of the data requirements that we set out. A lot of this is being driven by cost recovery and the whole interest in everybody to be more efficient than we were in the past. Another thing is we are looking at a whole new way of doing business that is having the electronic capability internally. We have an electronic environment and submissions are coming in electronically. On the whole review side within the Agency, we now have a consolidated approach for decision-making. It is called the Science Review Team. That is where all the key divisions really get together to discuss and consider whether or not a product will or will not be registered and under what conditions after all the information has been reviewed. This is a very different approach than in the past where the various departments made different decisions. It was very difficult to pull those together and make a consolidated decision or have one direction. In years past, because of the data coming in various pieces, sometimes the time from the first piece into a registration decision was very long. Now, we are committed to an eighteen-month review time. So, if the data package is complete, it comes in through screening and we commit to an eighteen months review time. This is a significant improvement over the previous years. In other areas, where there are some specific programs, for example, now we have the capability to share work with the US and we have two avenues for joint reviews. There is a twelve months period for joint reviews, minor use and critical need. The logic there is because we are sharing work, we can get it through the system a little faster. By getting it through the system, I am not saying getting it registered or not. I am saying making a decision.

Just some basic highlights of the regulatory process. We view it as a science-based regulatory process. We like to think it is objective and unbiased, because it is based on science. We like to think it is open and transparent. We are certainly moving in that direction. Essentially, the whole process is based on it, and this is where the regulation of pesticides in Canada is very different than the regulations of other chemicals in the pesticide regulatory system.

Our whole system is geared to an extensive pre-market review process carried out by PMRA. That means that before it is ever used in Canada, other than research and through research permits, there is a high level of risk assessment done before it is used. It has only been since 1992 that internationally countries have started to work together in this area of pesticide regulation. I think we have probably said this ten years before, that Canada was one of the best among the leaders in pesticide regulation or had the best regulatory process or one of the best within the developed countries. I think we are fairly confident now that this is relatively true. We are probably right up there as far as asking the right questions, the data requirements and the review process. We have established a good relationship with most of the developed countries and we understand each other a lot better. Our review procedures are comparable to other leading countries.

What is required in the regulatory process? (This applies to all pest control products, not just the ones used in forestry). We have agreed that it is an evolving science-based process. So, things change over time. When we realize that is not a piece of data we actually need, we can get rid of it. We also realize that we may need a piece of data in a different area and then we may have to require that. We need formalized data requirements in the whole area of pesticide regulation. The submission of data by companies is the critical piece. Companies develop data according to international standards. The background to that is that we develop what is required for that submission through the regulatory agency in Canada, and often with regulatory agencies around the World. In addition, you back up one more step. The ways that the tests are carried out are established internationally using scientists in specific areas from all over the world. That is the way it is done. I will talk about it later under the Organization for Economic Cooperation and Development (OECD), which is a group where developed countries work on a variety of things, including this.

You have the test guidelines that are developed internally. That means that when a company sets to carry out a study, they have to do it a certain way. I am trying to say that there are a lot of checks and balances in the system. The data requirements are formulated in most countries, including Canada. The company has to submit a complete set of data to PMRA.

If the set of data is incomplete, it will not be accepted. It will be sent back to review divisions for risk assessment. We have a division that assesses risk to health. We have a division that assesses risk to the environment. And, we have a division that looks at the whole value component.

What is required in the extensive data requirements? We have a division that makes sure that what the company has submitted is actually that particular chemical or that particular biological product. That is the chemistry and identification part. We also have the health part and the environment part that I mentioned. Finally, the value component looks at whether the rate that is submitted is the lowest rate possible. You are talking lowest rate, lowest dose, lowest health and environmental risk. It is a critical piece. Another part in the value is looking at the whole sustainability implications. Does it impact on individuals? Does it fit in an IPM program? Are agriculture resistance issues a big deal? Not so much in forestry.

Looking at the decision-making in the regulatory process, we are looking at integrating all the elements that come in. So, you are looking at the health risk assessment, the environmental risk assessment, and the value components. All those things are looked at in an integrated fashion through the Science Review Team. Risk management or risk mitigation is talked about. Our goal is certainly a balanced science-based decision-making process. Just to let you know, the answer is not always yes. Many of you in forestry can probably appreciate that. But, when we are looking at making a regulatory decision, there are a variety of regulatory options. You can say no. You can ask for more data. It can be a Temporary Registration and in those conditions, there is a component that requires more data. You may modify the conditions of use, you may set out specific ways it can be used. You may agree to register it.

When I talked about the transparency issue, what we have instituted now with any products that are new actives or significantly new, that have been submitted to the Agency after April 1st, 1995, fall into the category of requiring what we call a Proposed Regulatory Decision Document.

This is the part of what we hope lends itself to the transparency portion which is once we make our proposed regulatory decision on these major actives or major new uses, a document goes out to a wide variety of stakeholders, so that we can get their perspective. It is not until after this consultative process that we look at making a final decision. That is all carried out within the 18-month period.

I have alluded a little to the International Harmonization issue. I know everybody in the forestry business is very aware that your product will sell all over the world and that the whole issue of globalization is very true and has been for forestry for many years. I think, as I said in the pesticide regulatory business, it really only hit us over the head about 1992 when a specific organization was set up so that countries could work together. This organization is called the Pesticide Forum under the OECD umbrella, which I talked about before. Essentially, that has given us a lot of opportunity to work towards similar data requirements in all countries, similar review processes and similar submissions. If a company prepares a submission for Germany, it could also send it to Canada. We are doing a lot of exchanging of reviews. What I mean by that is that when a country reviews this big data package, they do summarize each of the studies and sort out some objective and scientific perspective on those studies. Those sorts of pieces of information can now be shared between countries and it is a very good way to share work and speed up the processes without putting health or environmental issues at risk.

From the forest industry perspective, there may be a couple of things that you are interested in. One of them is that we have now harmonized our data requirements in the area of pheromones with the United States. Canada is leading a project within OECD to harmonize data requirements for all the developed countries. What this will mean, I hope, is that companies with pesticide industries or registrants will be more interested in pursuing registrations in countries like Canada, so that these sorts of products may be accessible. A second project that may be of interest relates to microbials and B.t. B.t. is now the work force in the forest industry for forest protection. I know one of the issues has always been access to additional types of tools in Canada.

We are now about two-thirds harmonized with the US for data requirements in the area of characterisation and in the area of health. We still have issues in the environmental side. There is a project that started in February of this year. This project is looking at moving the whole data of the developed countries to one set of data requirements. So, US and Canada are working with the European Union and some of the other non-EU countries to do this. The first meeting on this issue will be held on August of this year. I think it is a fundamental step forward. If we have one set of data requirements for most of the World, presumably that will facilitate access. Those are some of the things that are being done. Both countries, Canada and the US, are very active in this.

Under the NAFTA, which is the North American Free Trade Agreement, there is a Technical Working Group on Pesticides. We have a mandate to have a level playing field within five years. Our first goal is to harmonize data requirements. The second goal is to harmonize and make sure that the protocols are acceptable. And, the third goal is to look at the risk assessment process and to make sure that we are headed in the same direction. There are a number of fringe issues along those lines, but just to let you know that this is an incredibly active area.

I guess another issue is on the risk reduction activities under NAFTA and OECD. They have been fairly active over the last few years. Countries are very interested in them. In fact, there is an IPM workshop under the OECD umbrella this June. It will really be fundamental. It is the first one in the World where countries are getting together to talk about Integrated Pest Management. What does it mean? What is its contribution to risk reduction? What are the impediments? This was a highlight on the international stuff that I touched briefly on regarding sustainable pest management. This is what we mean by it. It is really building on the concept of sustainable development.

PMRA is committed to encouraging the development of sustainable pest management systems. It is meeting society's needs for human health protection, food and fibre production, and resource utilization. It is conserving and enhancing natural resources and the quality of the environment for future generations. And, it has to be economically viable. I am going to add an additional twist to all of this sustainable pest management issue.

A number of you may remember that in 1992, all countries met in Rio for the UN Conference on Environment and Development. At the end of that conference, all the countries committed to the concept of sustainable development. Last year, Canada implemented on that commitment by changing the Auditor General's Act, making all Federal Departments develop a Sustainable Development Strategy (SDS). SDS consists of goals, objectives, targets and action plans, and measurable results. Since we are part of Health Canada, we are involved in that. So, just to let you know that this is not just a PMRA issue. It is a national and an international issue.

Our goal, from an agency's perspective, is to work with a variety of stakeholders to support the movement forward in this whole area. More specifically, our goal is to work towards the development and implementation of policies and programs that help make measurable progress in sustainable pest management in Canada. In this area, we have been involved in some rather interesting projects. One of them that just got initiated April 2nd and 3rd, was the spruce budworm IPM project. The idea behind these projects is really to work with users, producers and other stakeholders, to develop an Integrated Pest Management Strategy that works for their particular resource or commodity. The types of projects are varied. I think the key issues are that they are user-driven, they are voluntary, and this allows the cooperation of all tools. Pesticides are often a key component. We are very interested in supporting and in looking at all tools.

In summary, as an Agency, we are really striving to facilitate access to new technology. The concept is that the newer products tend to have a better database and they tend to be more targeted. The sense is that the new products are less risky and more acceptable. We are interested in finishing the backlog, because it is bothering us and we cannot get on with other things. We need to move on reevaluation. This means looking at all the existing registered products in some methodical way to make sure that there are no unacceptable risks associated with those products. Our intent is to consult on this issue. But, the basic idea at this point is to build our reevaluation system on the US approach and with other countries, so that we can utilize their reviews and their decisions. Sustainable pest management is something that we are very interested in fostering and supporting.

Sustainable pest management includes the whole issue of Integrated Pest Management and integrating the concept of sustainability into our decision-making process. We are trying very hard to be efficient, and we are certainly working in a harmonization area. The fundamental bottom line for us is to minimize risks to the health and the environment, and this is what we think we are doing.

From my perspective, there are two areas that I see as a challenge. The first one is the understanding of and the confidence in the federal registration system. How do we get that message out? What do people see as issues? How do we correct those? That has been a perennial problem of the regulatory system, not just now, but over the years. When the pesticide registration review was done in 1989 and 1990, that was a fundamental thing that came back from that. People do not know about the regulatory system. They do not understand it, and they certainly do not trust it. So, the whole issue of having a federal regulatory system is that the province has used a piece of it. Then, they add their own rules to it and do their own thing. Essentially, we are really joined at the hip. If there is not any confidence in that federal piece, then it does not help the whole system, and particularly, the forest industry. The second piece is the understanding of and the confidence in the whole issue of Integrated Forest Management, and Integrated Forest Pest Management. Do people know that? Do people understand that? Do they recognize it? Do they know what that means? The part that I did not understand or get, was that I was supposed to lay out which agencies needed to be involved. From my perspective, we have a role to play here. I think, potentially, the provinces and ourselves have a role to play, but probably everybody else, because we have to find a way to get the appropriate message out. I guess, the second thing is this whole area of forest management and Integrated Forest Pest Management.

I would be happy to be supportive and part of that. It is the forest industry and the forest managers that presumably have had some roles to play in getting that message out. So, that is really all I have to say, here, today. Thank you very much.

Louis LaPierre: Thank you very much Wendy. We might have time for one question.

Unidentified: Wendy, I have one quick question. From your knowledge of the PMRA and the industry, if I had a new B.t. product, what is the total time frame and the total cost before that product gets registered? Take a wild guess at it.

Wendy Sexsmith: Well, no I will not take a wild guess. If it is a brand new biological active ingredient, and if the data package is complete, the commitment is eighteen months. The second issue was cost. There is no cost recovery at this point on microbials, pheromones and a number of other products. Most of the cost recovery, without getting into details, is on the traditional chemical products.

Unidentified : What is the cost of the supplier to put together that data package?

Wendy Sexsmith: You would have to ask the supplier, because each supplier would probably give you a different number. As far as their cost at our level, it is not, like what the cost is for the traditional chemicals. Because, it is all costed out on data requirements, it is somewhere around 200 000 dollars for a new technical and an unused product. So, that particular cost would not be applied to a new biological product.

Roger Bernier: On the new set of regulation PMRA, you mentioned something about the process of getting registration or when you submit your product. You mentioned something about either the decision or the information being sent to a group of stakeholders for review.

Wendy Sexsmith: What I was referring to, at that point, was that after the data package has come to the Agency, it is complete. So, it goes through the system, and the various divisions that are reviewing it, look at it. We go through a science review team integrated decision-making approach. We come up with a proposed decision. It is really the documents that go out, but there have not been many at this point, I have to say. The documents that go out are essentially a summary of the evaluations and assessments. So, it walks people through what the chemistry is, and what the health information is and says.

Then, if the environmental issues and the value of the document are okay, it comes up with a Proposed Regulatory Decision. That document would, then, be published. It goes out for public consultation, and there is a time frame, I think it is forty-five days. Then, the document comes back, we deal with the comments and we make a regulatory decision, given all of that.

Roger Bernier: So, what criteria are used for that review? And, who are the stakeholders?

Wendy Sexsmith: Well, there is no criterion, because we cannot tell people what their comments are going to be. The stakeholder group would be anybody we have on our list. So, it would be all the registrants, the environmental groups, and the forestry community, these kinds of people. It is very broad.

Roger Bernier: What if your recommendation, prior to this process, is to accept the chemical or biological product, and then, it comes back from this review process with different views. What would you do?

Wendy Sexsmith: We would have to consider the comments and make a decision based on them.

Roger Bernier: But, would those comments be science-based comments?

Wendy Sexsmith: They would be a variety. I mean you have to accept that there is going to be science-based comments, and there is going to be other perspectives. The whole idea is to try to find ways to be more transparent in our decision-making process. This was a recommendation that came out of the stakeholder review in 1990.

Roger Bernier: I understand, but how would that fit with a science-based process, if you allow no scientific judgements or facts to interfere with the process?

Wendy Sexsmith: But, I think it is important that everybody understands that regulation, whether it is pesticides or other things like drugs, it is a balance of science and public policy. I think in New Brunswick, and you probably know this better than anybody, that just because science says something that does not mean you are going to do something. I think the evolution away from traditional chemical products has shown that. We, as a regulatory agency, have to consider those sorts of things. Obviously, though, if comments came in that had no merits in any way, we would not be able to consider them. Or, if we had science-based responses to those kinds of questions, we would not be able to consider them either. That is how we would deal as much as possible. But, clearly, if we were looking at registering a product for use in Canada, and every province in Canada came back and said don't you dare register that product, for certain reasons, we would have to find a way to consider that. I think this is very legitimate, because, you know, we do not know everything. In fact, we only know a little piece of the whole system. So, regional issues and concerns have to be considered as important.

Louis LaPierre: I think we will thank Ms. Sexsmith for her presentation and the answers to the questions. She will be back at 4:00 o'clock. So, we can save our questions for later. This will also give us a chance to offer our questions to all the panels.

The next presenter is Greg Shanks. Greg Shanks will be following up on Wendy's presentation, to give us the provincial perspectives. Mr. Shanks' presentation focuses on where it falls at the provincial level.

3.7 ENVIRONMENTAL PROTECTION AND INSECTICIDE APPLICATIONS

Greg Shanks: This presentation is really going to be low tech. I have one slide to offer. After lunch, I find that the stomach has sent a message to the sleep node, and everybody is way down. I expect that most of you would have thought that Ken Browne would be here today. But, he has decided and was granted an early retirement from DOE, after, I do not know, twenty-five years, thirty-five years of service. Unfortunately, you are stuck with me.

Mr. Browne is apparently very busy with a Consulting firm. He drops in the office from time to time to "chew the fat". But, he is busy. I bring up his name, simply, because Ken had a significant input of the regulatory process for the province of New Brunswick. He was a firm believer in educating the people who were using pesticides. He also promoted an integrated approach to the use of pest control products. His philosophy can be seen in the current legislation that regulates the use of pesticides in the province, which leaves me with an out. So, if you have any problems, blame Ken Browne.

(How about those Edmonton Oilers? You have to like them. They are coming back, finishing off the Colorado Avalanche. As a consolation, for you Avalanche people, we have three Canadian teams in the second round of Stanley Cup Playoffs. This could not be better. I will leave you a food for thought. What about the Montreal and Ottawa series? Think about that.)

I put up this one and only slide that I have to give you a flavour of how the Department has reacted in the past three years to applications. We have only had to deal with a few as compared to previous years. The year 1994 was the largest budworm control program we had. Twenty-seven thousand hectares of land were treated for budworm. I do not know if that was actually completed. This is just the application that we had to deal with. In 1995, we had a combination of budworm, sawfly, and some research. This was the same situation for 1996. In 1997, we had no Permits or no applications for Permits. It is simple to summarize the regulatory process in the province. But, I will not get into all the specifics of the Pesticides Control Act and Regulation. You would be here all afternoon.

Should a decision be made to use a pesticide for budworm control, the regulatory process known as the Pesticides Control Act and Regulation, kicks in with a number of specific requirements. In the interest of avoiding an information overload, (there has been an awful lot this morning), I am going to restrict my comments to four areas of the Act. These areas will provide a good framewok, particularly for those who do the actual application.

The Act is specific. The four areas I want to talk about are the product Registration, the Permit process, the Certification process and the Operator's Licensing process.

With respect to the product Registration, this is done at the federal level, and we insist that all products are used according to Label instructions. The province does not have the expertise to properly assess these products. So, we rely heavily on the Federal Government to do this for us. With respect to the Label directions, the province does take some latitude in including, on the Permit, some additional requirements for Operators, particularly, with respect to setbacks. The second thing, the Permit is the approval issued by the Minister of the Environment to ensure a safe and effective use of pesticide control to minimize risk to off target organisms and the environment. The Permit restricts the applications of pesticides, to establish the setbacks, from habitation and from aquatics, whether it be a surface water supply, rivers, large lakes, or ecological reserves. The Permit also sets wind speeds for applications, addresses the requirements for certification, safety equipment, storage and disposal of containers, notification, and reporting requirements. So, the Permit is really a key instrument in the whole process. The Pesticide Unit of the Department of the Environment has had the opportunity, over the years, to develop the Permit, so that it is current, and hopefully, addresses the issues that have been raised historically. The third aspect of the regulatory process has to do with the Certification. Basically, anybody who uses, applies or is involved in the supervision of any of those people that do that application, must be certified under the Pesticides Control Act and Regulation. We include such people as pilots, spotters, supervisors, mixers and loaders. Basically, everybody that would come in contact or have something to do with the use of the product. One thing that I should mention is that we have some funding under the Environmental Trust Fund, this year, to put together an Aerial Applicator's Training Manual. Until this point, we have not had anything provincially, but we should have something before the end of this year.

The fourth component of the regulatory process deals with Operator's Licenses. These Licenses are issued to the company or the business involved in the application of pesticides for fee or reward. It does carry with it a requirement for liability insurance.

The regulatory process is basically the same for both operational applications and those done on a research bases when conducted by aerial means. So, there is no distinction between research and operational applications. Ground applications, however, for research purposes or for operational requirements, are treated a little differently. I am not going to get into that.

Historically, the government of the day has always supported attempts to protect high-value forest stands deemed to be vulnerable to insect attack. During the last few years, the level of activity has diminished. So, has the use of pesticides. Information presented this morning suggests that insect populations will increase and we will soon be required to respond to the challenge of protecting the forest. Fortunately, through sessions like this one, we will be in a better position to respond. (How about those Oilers?) Thank you.

Louis LaPierre: Are there any questions for Mr. Shanks? No questions. Well, thank you very much for the presentation, Mr. Shanks. I hope the Montréal and Ottawa series comes through for what you are wishing.

The next presenter, and I know he is not retired yet, so I know I am safe here, is David Coon. Mr. Coon is going to present the non-government view of the environmental implications of insecticides. David Coon is with the Conservation Council of New Brunswick.

3.8 ENVIRONMENTAL IMPLICATIONS OF PESTICIDES

David Coon: Thank you very much Dr. LaPierre. Good afternoon. The title of this conference, Forest Protection and the Spruce Budworm is a misnomer. The spruce budworm has coevolved with our forest, and ecologically plays an important role in forest succession. In other words, periodic outbreaks have been a normal part of the ecological dynamics of our forests. For example, USDA Forest Service Researcher Gordon Mott suggests that the spruce budworm helps maintain the dominance of red spruce in the Acadian forest. He hypothesizes that during periods of spruce dominance there would be fewer and less severe budworm outbreaks.

During the longer period without severe budworm attacks, disturbances would again favour fir regeneration, until its proportion would be high enough for another budworm purge. The point is that periodic budworm outbreaks have had an ecological role to play. Rather than pose a threat to the forest, the budworm in fact is part of the forest. Clearly, what we are talking about today is protecting the timber supply, an important economic value in our province.

What does seem to be both an ecological and economic problem is the frequency, extent and severity of budworm outbreaks have increased dramatically during this century. While earlier outbreaks were isolated and relatively small, the outbreaks in eastern Canada since the turn of the century have increased in size from ten million ha in 1910, through 25 million hectares in 1940 to 55 million ha in 1970.

Why? This has been attributed to changes in the forest ecosystem largely caused by those timber management practices that have precipitated an increase in the abundance and frequency of balsam fir while diminishing the abundance and distribution of red spruce, hemlock, cedar and sugar maple. A recent study done in Kings County, NB estimates that the frequency of balsam fir in the forest has increased three-fold over the past two hundred years, with significant declines in red spruce, hemlock and cedar.

Which timber management practices have been the problem?

Those silvicultural treatments such as clear-cutting that favour fir regeneration. Herbicide and fire control where they have prevented the formation of a stand mosaic of spruce-fir and hardwoods. The elimination of brush by herbicides is also thought to reduce the budworm's predators. The establishment of white spruce plantations (along with the reversion of former farmland to white spruce). And Insecticide spraying which can prolong infestations or shorten the interval between outbreaks.

The bottom-line? The forest management of yesterday and today affects the severity of the budworm outbreak tomorrow. Management has resulted in lots of even-aged stands loaded with fir. So the budworm threat to timber supply has been somewhat self-imposed.

Now this has been long recognized. Following the outbreaks of 1910, entomologist Fr. J.D. Tothill wrote : "In the primeval forest, there were no important outbreaks of insects because Nature had established a natural balance that prevented any one insect from becoming too abundant. For a century, we have been working in direct opposition to Nature and in the course of our ordinary lumbering methods have finally succeeded in destroying this delicately adjusted balance."

Tothill recommended that New Brunswick implement management practices to restore the natural species mix, otherwise, he argued the next budworm epidemic would come sooner and with greater severity. His advice and similar advice by others, right up to the recommendations given by CFS's Dr. Loo and others in this very room six months ago at the last forest protection conference sponsored by the Premier's Round Table, was and continues to be ignored.

The results? The spruce budworm outbreak of 1940 was indeed more than double the size of the previous one, which more than doubled again, resulting in the largest, longest-running aerial insecticide program in the entire World, imposing a host of ecological and health risks on the province.

Such a massive experiment in ecotoxicology revealed a variety of unanticipated impacts on and risks to forest species and processes. This contributed to the banning of DDT, its impacts in the Miramichi so eloquently described by Rachel Carson in her seminal book, *Silent Spring*, and resulted in the banning of its replacement, fenitrothion.

Despite assurances to the contrary by government and industry, after two decades of spraying fenitrothion, a federally registered insecticide, it turned out to be unsafe.

The overwhelming scientific evidence collected, largely under the auspices of the Canadian Wildlife Service, demonstrated that pollination, an ecological process fundamental to forest function, was being effected negatively, as was the reproduction of songbirds, and the abundance of aquatic insects. So fenitrothion can no longer be sprayed aerially over forests.

And here we are again, in anticipation of the next budworm outbreak, with industry and government looking for something else to spray.

The biggest issue from the Conservation Council's perspective is how can forest policy in New Brunswick be changed to return our forests to a more natural landscape condition so that we will not be continually facing the prospect of aerially applying toxic chemicals, biological toxins, or genetically-engineered lifeforms over our province.

As the Conservation Council's first honorary president and eminent entomologist, the late Reg Balch, inscribed, in a copy of his 1965 book *The Ecological Viewpoint*, "studies of the dynamics of insect populations have shown that good forest management is basic to the control of damage by most insects and diseases."

This has been ignored on Crown land, industrial freehold, and on an increasing number of woodlots as volume-driven timber management and single-species management substitutes for forest management. Timber management has got to begin to take place in the context of forest ecosystem management. In the New Brunswick context, this means setting our sites on restoration - restoration of ecological function in our forests by restoring the underlying processes and biological diversity. This has been and continues to be the position of the Conservation Council of New Brunswick.

Right, many of you will say, that is all good and fine, but that will take a long time, and we have to do something to minimize the loss of trees to the budworm when the next outbreak comes around.

No doubt this was the same point made in 1949 when foresters confirmed an alarming increase in the spruce budworm populations in the Upsalquitch watershed on Crown land leased to the company that was operating the Dalhousie newsprint mill. And it was made again in the 1970's.

Once again, the pressure is on. At the outset of the next outbreak, dire warnings of economic catastrophe will again issue forth from industry and government. And the public battles will begin.

Now the last time, when the budworm battles were at their most furious, the Spring of 1976, I was a biology student at McGill, and some of you may not have been born. Interestingly enough environmental groups were not at the forefront of the debate. Rather parents had organized to halt the insecticide spraying.

Ecological concerns, and there were many, had been overwhelmed by the death of a 10-year-old boy from Durham Bridge, Timmy Keddy. Timmy had died from Reye's Syndrome three years earlier. His doctor at the Isaak Walton Killam Hospital in Halifax was Dr. John Crocker. Dr. Crocker and his associates had been seeing an inordinate number of cases of Reye's Syndrome in children, concentrated in New Brunswick. Between 1971 and 1973, nine children developed the syndrome following the flu and, five of them died. The one thing they had in common was that some of the symptoms looked like classical symptoms of insecticide poisoning and they all came from areas of the province that had been consistently sprayed. Dr. Crocker initiated a series of laboratory trials on animals with corn oil, DDT and fenitrothion and a non-lethal virus. The fatality rate from this non-lethal virus ranged between 33% and 60% when the mice were exposed to the combination of DDT and fenitrothion. The results were published in the medical journal *Lancet* in 1974.

In 1976, the Nova Scotia government cancelled its planned 100 000-acre spray program for the Cape Breton Highlands for "medical reasons." In the Spring of 1976, Timmy's Mom agreed to an interview from CBC in Fredericton and aired her conviction that his death was linked to the spray program. On top of this there were rumours of a return to DDT.

The biggest spray program in New Brunswick's history was to be mounted that Spring, covering ten million acres. While all of these events contributed, the possibility that a connection may have existed between the spray program and the death of New Brunswick, children from Reye's Syndrome ignited a massive public debate led by the Concerned Parents Group, formed the day following the CBC interview with Timmy's Mom.

Jessie Davies, one of their earliest members, following a meeting with the provincial Cabinet, was quoted as saying : "We want to talk about human beings and all they will ever talk about is their bloody cunits." Government argued that it needed conclusive proof that the children's deaths resulted from the spray program before taking any action on the spray program. Of course citizens argued that if there was a possibility of a connection, then children should not be put at any further risk.

In referring to the government's decision to press on with the massive spray program as planned, Natural Resources Minister Roland Boudreau said, "I do not like to see people dying. This is one of the things I really would not like to see. But at the same time, knowing the forest as it is, my decision will have to be with the forest and with the future of New Brunswick."

To my knowledge, Mr. Boudreau was the only government official who acknowledged there were risks of any kind associated with the spray program. He and his government just judged them to be acceptable. Many citizens did not.

Much of the battles around budworm spraying had government and industry denying that any risks existed. Citizens set about researching and highlighting those risks that had in fact been identified in the scientific literature. Citizens argued that the risks were unacceptable. Natural Resources Minister, Roland Boudreau while acknowledging there were risks insisted they were acceptable in the face of the available alternatives.

In Nova Scotia, the government took the opposite view. The risks were unacceptable. The Cape Breton Highlands were not sprayed with anything and the mainland received only B.t. The results? The health and ecological risks of spraying fenitrothion were avoided. No mills closed and no one was thrown out of work.

So, when it comes down to aerial spray programs and people in a democratic society, the issue at hand is really the acceptability of the risks involved. When risks are involuntary, the benefits of taking those risks are not direct, and the consequences are potentially catastrophic as in the death of children, whatever their probability, many citizens find such risks unacceptable.

This gets directly to the second issue that I would like to raise for discussion tomorrow. How do we ensure that the particular risks of both another budworm infestation and of spraying any new substance or lifeform over New Brunswick are identified, presented to New Brunswickers, and widely debated? For it is only through such public debate that political representatives can arrive at some reasonable assessment of what action best serves the public good.

Voting a government into power does not give them a blank cheque to do what they please. That is not the basis of our parliamentary democracy. Nor is it a healthy situation where much of the outside advice received by political representatives comes from private interests with the occasional delegation from one citizen's group or another.

We need a decision-making process that engages both aboriginal and non-aboriginal communities in the debate on a regional basis. I would suggest that it should be a committee of elected representatives that engages citizens. One thing is for certain, simply a recommendation to the Cabinet from the Natural Resources Minister based on advice from his staff and on lobbying from industry is unlikely to be acceptable to New Brunswickers. The times are different. The context is different. And, society is different, today.

It should be an interesting couple of years, thank you.

Louis LaPierre: Thank you very much Dave. Are there any questions or comments for Dave?

Max Cater: Normally, I do not have any comments to make about what David says. But, I thought I would make a few, here. I was around in the Dr. Crocker days. We met some nights, way after midnight on meetings about Dr. Crocker and the Reye's Syndrome. The potential for Reye's Syndrome is still there, because of the results of the research. It was into the aspirin bottle. It was not in the fenitrothion or in the emulsifiers at all. Now, you could have said that, David. But, you did not.

David Coon: I can respond to that Max. First of all, you are not being completely honest about that. Aspirin is absolutely a risk agent, as was the formulations used.

Max Cater: They never found any from the research done by the McGill people.

David Coon: That was never disproved. But, my point of talking about that was to give a sense of the temper of the discussions of those times, and the discussions around risks. Because, those discussions were raised. And, there were legitimate concerns based on the information that existed at the time. The question is, how do you deal with that?

Max Cater: That is true David. Foresters do not like to spray. We do not want to spray things. But, when we do, it is for a reason. And, looking back now, at what you have giving here, I have to speak in defence of my involvement in this. The aspirin comes up because we financed Dr. Crocker a lot. Bud Irving is here and he can tell you that. We financed the research he did down in Cape Breton Island. The Federal Government reports thirty-five million cubic metres lost in one year, from not spraying. It is sure that we did not lose jobs. But, there were not any jobs created either. Do you know how many jobs would be created by the New Brunswick standards, for twenty-five years? There would be 4 200 jobs created. When did you see, a week hardly, on T.V., that people are rioting in Cape Breton, over jobs. They have no jobs. They are burning apartment buildings down there that are partly constructed.

This is a very serious situation. Another thing is that the reports that you referred to of fenitrothion that is being deregistered. How many in this room know what *Aralia nudicaulus* is? Put your hand up, if you know. David are you one of them?

David Coon: Certainly not by that name.

Max Cater: Well, you can put the cover back up on the deregistration of fenitrothion. They refer to *Aralia nudicaulus*, which happens to be a wild sarsaparilla. The term, *Aralia nudicaulus*, long before fenitrothion, was on the market. It goes back years and years. But, as they were pollinating or making fruit, you can find it in the woods year after year and see that the plant, it's perennial, has no fruit on it. That is what they used for the justification of pollination in your report.

David Coon: It is not my report, Max. It is Environment Canada's report.

Max Cater: I realize that, but it is full of probabilities.

David Coon: I did not deregister it either. The Federal Government deregistered it, based on the data that was presented.

Max Cater: That is true. But, it is full of probabilities. And, the science in it was not very good. This is from what I have read, and I do know a little bit about some things in there.

Louis LaPierre: Dave, do you have any comments?

Christy Hunterdicksen: I was just wondering if you could tell everyone here, what you know about the release of xeno estrogens when pesticides are sprayed. And, how those are thought to be linked to breast cancer in women, and impotence in men?

David Coon: I sort of alluded to that, in the sense that there is a whole new body of information around health risks associated with certain pesticides and other industrial chemicals. Like some metals, and so on, that has to do with their impacts on reproduction and human development by mimicking the action of human hormones. This is kind of a whole new breaking area of toxicology. An area that needs to start factoring into decisions about evaluating substances that are going to be used and released into the environment. Maybe Wendy can talk about whether that is happening, or how she sees that happening. But, that is an area of significant concern. Because, what is appearing to be the case, is that some substances, and I am only speaking generically here, but some substances, which otherwise would not appear to have toxic, particularly toxic concerns associated with them. Those substances can have these endocrine disrupting impacts or risks associated with them, and that is obviously a cause for concern. A lot of the focus, was not so much on the spray program, because we had concerns about Reye's Syndrome, and the birth defects. But, a lot of the concerns in the past from pesticides have tended to overly focus on questions of cancer. And, they have not nearly focused enough on questions of development and growth impacts on that, both in foetuses and in young children. Particularly, those nervous systems that are not well developed. So, this is a whole new area of concern for the broader society. I am not certain, at this point, of how it is, yet, being considered. Maybe, Wendy could speak to that.

Louis LaPierre: I think we will take a few questions. Wendy, you might plan on speaking to it, after the presentations this afternoon. There is a question over here.

Blake Brunsdon: First of all, David, I would like to thank you for making the effort to come and to talk to the group, and tell the group how you feel. I wanted to tell the group how I felt. I have been working in the forest industry for the past twenty years. And, I have been doing exactly the things that David MacLean says that we should be doing more of. I agree with him, there is always room for improvement. But, I have been working hard over the past twenty years, and the people I work with have been working hard over the past twenty years at doing a better job of management of the forest, so that it is more resistant to the spruce budworm. I can think of the things that we do.

We have been running around, trying to direct our harvesting right into the areas where the budworm killed the fir. So, we are trying to use the wood that has already been used by the spruce budworm. On many of these areas, we have been trying to regenerate them back to species that are less susceptible to damage by the spruce budworm. We have been doing that for years and years. Many of these sites regenerate naturally on their own. In those areas, we have been trying to use silviculture tools, the brush saw, to manage them. To favour species that are less susceptible to the spruce budworm. Dave MacLean presented evidence that these sorts of stands are less susceptible to spruce budworm. We are doing select harvesting. And again, we are trying to target our removals to the trees that have shown damage, that are over mature, or that are more susceptible to the spruce budworm. And, we are trying to promote the longer-lived species that are less susceptible to the spruce budworm. In our tree-planting program, in the tree improvement work that we have been doing, we are trying to go out into the forest and find the less susceptible trees. And, then we try to select those local seed sources and breed them. That is what we are replanting our stock with. So, it has been forty years of the same thing. When will you guys wake up? I do not think that is a fair comment. I am sure that there is room for improvement, like in everything, and everywhere. But, I think we have a good story to tell, and I am taking the opportunity to tell it. My final comment, is that I am really disappointed that you are not going to be available to participate in the discussions tomorrow. Because, that is really what we need. We are concerned about finding or making a tool kit that is the best set of alternatives to deal with the situations when we have them. To have people come in and throw the rocks. Then, they leave and come back later. I am not saying you are doing that. But, there are a lot of people who do that. They just shoot rocks, but they do not want to participate in trying to find the solutions. I am hoping that there are going to be a lot of people that think like you at the workshops tonight and tomorrow. So, that we can really come up with something that we can live with. Thank you.

David Coon: I seem to be a popular guy. But unfortunately, I cannot be here tomorrow. Just a point on silviculture, what I said was specifically regarding the issue that I raised regarding public policy. How do we make sure that public policy around the forest ensures that these kinds of things, from a long-term perspective, are done on the ground?

That was the issue. Not this company or that company, but public policy. Remember that a lot of the presentations, here, have been at a technical level or from a manager's perspective. But, the field we work in, is public policy. So, these comments are directed at public policy. There are two issues. The first one was, how do we make sure that public forest policy of this province is appropriate to incorporate the kinds of issues around silviculture to reduce the mortality from budworm infestations?

The second issue was, how do we make sure that public policy in the province, is such that we have a wide range of public and that elected representatives in this province are fully engaged before the next outbreak occurs? Those were the two issues of public policy that I raised in my presentation.

Louis LaPierre: There is just one more question here.

David Oxley: David, you had mentioned earlier that you felt that elected representatives should be engaged in public debate directly in the communities around the province. Rather than relying on staff, and working through staff to a Minister, and to the Cabinet to make decisions. I am wondering if you do not fear that there could be a lot of decisions based on emotion that way, where you can get a public meeting. If the public meeting happens to be stacked one way more than the another, perhaps emotion enters more than science and good reason.

David Coon: I guess, I fear more that decisions are made based on the strength of lobbying by companies like yours, Dave, than on a rational weighing of the risks to make the decision in the best interest of the public good, whatever that might be. I think that is why it is important that the information get out there. That discussions occur, so that these are meaningful debates. There is nothing clean and straightforward about trying to engage public debate around an issue of public concern. It is kind of an unwieldy, messy process. But, certainly, in this province, we have done quite a lot of that in the 1990's around a number of issues.

I think that there is an opportunity, here and now, to start looking at this from that perspective. Because, otherwise, I do not know how else you are going to deal with this in a way that is not going to simply blow up into a massive situation of a waging lure around public policy, when we are in the mist of a crisis.

Louis LaPierre: Thank you very much for your presentation Dave. We hope that we can have the benefit of your comments, particularly comments on how we can address the issue of public education and public debate. I think it is a very important issue.

The next presentation is by Ed Kettela. Ed Kettela will give us an overview of New Brunswick's emerging budworm control options. The options that are available within New Brunswick, if we face a new budworm outbreak.

3.9 OVERVIEW OF NEW AND EMERGING BUDWORM CONTROL OPTIONS

Ed Kettela: Good afternoon. I have to tell you that sitting at the back of the room and listening to David Coon's interesting review of the past history, I got this feeling about just getting up and walking out of the room. I say that, because I lived through that period. I went through a lot of the slings and arrows that took place at that time. Do you want to know how bad it can really get? When your kids are harassed at school, because the parents tell their kids, that this is the guy who sprays budworm and who is killing little kids everywhere. That was the aftermath of that where I got a number of death threats. You have to stop doing this kind of thing. I am telling you when you are dealing with this bug, it is really personal. In my view, you get public policy at major changes because of fear, anger and perception. That is my view from what I have seen in the past in dealing with budworm and budworm control options. There is fear, anger and fury that goes around. That perception is reality. Science takes a back seat to perception, so you can figure that one out. Nelson Carter suckered me into coming and talking to this group again, and as he did, he gave me a list of things he wanted me to talk about.

First of all, I will talk about the overview of the new and emerging budworm control options. I just had this urge to walk up, put one thing down there, and say B.t. Then get up, walk out and say there it is, take it or leave it. He also wanted me to talk about what is on the horizon. Basically, it depends on how tall the tree is. So, you can crawl up and see how far the horizon is. As I go through the chemical insecticides, there is going to be a lot of question marks. The reason I did this, is because we want to question things. Are there any chemical insecticides being pursued or is this a dead issue? Biological insecticides, is there anything else other than B.t.? Contrary to popular opinion, fenitrothion is still registered. I found this out by the simple matter of calling the Pest Management Regulatory Agency and getting the information package on it. They just had their new label amended and approved.

I do think that the time line from now until its final demise is in another two or three years. There are other chemicals registered. I only want to go through what is registered. You have aminocarb. You cannot buy it, because they are not making it. You have trichlorfon, which is available and has budworm on the label. And, you have carbaryl. The first three chemicals were used in New Brunswick in varying amounts. Carbaryl, although it was made in the United States, is registered in the United States and in Canada. It has never been used in Canada. Carbaryl was only used in the United States, but the other chemicals were not. There is a long story behind that. I think it has to do with the Americans liking to poison themselves with their own homemade brand of poison rather than importing it. In the biological control products, we have *Bacillus thuringiensis*. This product has been previously used. Actually, there are ten different labels from B.t. products that are currently registered for use against the budworm. You can use a really weak B.t. product or you can use a really strong one. You can use oil based ones or water based ones. You can pick and choose. As it turns out and as time has gone by, a lot of the companies that manufacture this stuff have frittered away, because of declining sales over the years.

Now, you have to deal with very few companies like Abbott Laboratories and Thermo Trilogy, which is a new one. These companies are the only two. You do have another option that is called biorationals.

This means that it is a chemical, but it is a lot softer than anything else. Therefore, it fits into what they call the biorational package. In biorational control products, we have a product like tebufenozide (Mimic[®]), which kills insects by causing them to molt themselves to death. It is an ecdysone antagonist. This chemical is registered and it is available. To quote Nelson Carter, "the results that they got with it in 1995 do not make any sense at all." It does not have a long track record in forestry, and certainly at this time, it does not have the confidence in this part of the World.

There are pest control products of the future for spruce budworm. We will start off with B.t. Where are we going to go with B.t. products, all the ones that are registered right now? There is a fair bit of work being done by the manufactures in getting new products to the table in new strains. We have some really high potency products that are being worked on right now, like Dipel 96AF that is probably a year away from registration. That means you can use a lot less product to cover an area. Sometime in the next ten years, there is going to be new B.t. strains coming along.

There are a lot of different B.t. strains that are available. The B.t. strain is the only one that is used commercially. There are literally hundreds of them. If you climb up the pole further and you look into the horizon a little further, you could see viruses. T-3 virus or the budworm NPV virus is what it really is. There has been a terrific amount of work at the Canadian Forest Service, in our Québec lab, and in Sault Saint-Marie in the development of this particular virus for use against spruce budworm. How would it be used, in terms of space and time, has got to be worked out. However, this virus is off limit until sometime in the future. It will probably be available after the time the next infestation starts rumbling around. That boils down to B.t. and Mimic[®]. After all that list of chemicals, they are all registered, but are they socially acceptable options? The answer is simply no. Someone may have the temerity to try to use it. But, are they going to get the muscle to do it? I doubt it very much. Other biorationals are fermentation products of Actinomycetes. There is one currently being developed by Dow Elanco. It is called Spinosad[®]. It acts in a similar way to most other insecticides. It is natural, because it comes from a bacteria.

It is an extract from fermentation of an Actinomycete. The fact is that it kills insects in about twenty-three different Orders really well. Therefore, it will be a monstrous success somewhere down the line. But, will it get used in forestry? We do not know.

Now, I will bring forward the natural products. One of these products is Neem or extract of the neem tree *Azadiracta indica*. We have had a nodding experience with Neem, lately, mostly against yellowheaded spruce sawfly, where it performed remarkably well. As it turns out, the company that makes it is not in the least bit interested in pursuing the forestry market at all. They can make much more money selling it for its use, not against trees, but against lettuce and stuff that people eat. We had to look at the label, because some of the carriers that are in it, you would not want to spray it anyway. But, they are not the only company. This happened to be the Thermo Trilogy company, previously known as Grace Sierra. It manufactured Neemax 4.5. There are other companies that are interested in pursuing the Neem option. Again, sometime in the future, because you are talking about products that are very expensive to get, since they are actually in the extract of the seeds of the tree. Then, they have to go through the whole registering process. Somewhere down the line, there is going to be some Neem available. But, it is a long way off.

Now, I am going to talk about a pet of mine, the pheromone. Someday, someone is going to conduct the test with pheromones against budworm on an isolated patch that shows that you can alter the population. The nice thing about pheromones is that they do not kill anything. All they do is fix it so the insect does not mate. If it does not mate, than it does not lay fertile eggs, so no budworm. However, there is an interest in pursuing this, but there is not a lot money available to pursue it. The province of New Brunswick and other places have had to deal with this. It is starting to become the archaeological budworm past dealing with pheromones and their potential use against budworm. I think that something needs to finally be put to rest one way or the other. Will we be able to use the pheromone or will we not? In what context?

The other thing about all this new issue is the availability of the product. The best-use pattern is another thing. I will mention a few comments about these products.

B.t. has not been available, contrary to what the gentlemen said this morning. If you wanted to buy a couple of big tractor-trailer loads of B.t. in the mid-1970's, you could not. Even if you wanted to convert everything of budworm spraying to B.t., there was not a suitable formulation available. There was a very large test conducted in Québec in 1975. This test was done to leap frog science, and it had a lot to do with propaganda that did more damage to the eventual use of B.t. than anything else I can think of. This is trying to get things to the table faster than the science's merit. Most of the B.t. product has been used in Eastern North America, but it is not the only place where budworm outbreaks occur. All you have to do is look at Eldon's map of this morning, and see that it occurs in Newfoundland, all the way out to the Yukon.

Most of the B.t. product has been used in the declining phase of the population. The questions have been raised. How will we use this product in the rising phase when the populations are very vigorous? Will it perform as well with increasing populations? Because, the use of B.t. increased from 1988 onwards with increasing efficacy. I like to think that it was in large part due to that increasing efficacy, and that it was in large part due to the research that we did on it. But, I could be wrong. Maybe, it is not that. How will it perform? This is a good question.

The natural products, like Neem, when are they going to be available? We will go back to the virus. Will genetically-altered, manipulated virus ever attain registration status. Going into this biotech line here, are we going in the right line? What kind of pitfalls are there in the registration system that have yet to be tested out to get this to where we want it. That is a fact, if there is one. Will the cost of production of the natural virus, the one that we are working on right now, ever come down? Will we ever develop systems to grow enough quantity in it to do anything? You realize that with the test conducted last year and a test conducted this year, it took over a couple of hundred thousand dollars to grow enough virus to treat fifty hectares of land. So, there are a few technological gaps that have to be filled. The other thing with the virus is the conclusive positive test that is supposed to be happening. It could be happening right now, because they moved the test from Québec to Ontario, and now to Manitoba. It should be sprayed almost any day now, probably in time for the major snowstorm out there.

Once you get all these products, these viruses and pheromones, etc., how are you going to get them out there in a meaningful enough context to really mean anything? This is not something you are going to put there and say good, now you go out there and solve the problem. Perception is reality.

The only effective way to use them in a cost effective and efficacious manner is through an aerial application system. That means airplanes. This applies to biorationals, biologicals, chemicals and to pheromones. Otherwise, it is not going to get there. Where are we going to go in the future? On the radio a few times now, I have heard Nelson speak about where we are going to go with the budworm problem. And I said AH!, Nelson is now starting to talk the line. This is Early Intervention, to do something different. Not waiting for the next outbreak, and then to sit there, and watch it. This is why we are here today. It is simply not an option. If it is an option, then I say just take a look at the woods and go cut it. What can we do? We can do an Early Intervention. It all boils down to something practical that can be done with the use of the biologicals that we do have. And then, figuring out the right combination using Dave MacLean's DSS system to prioritize the forest. This is an option we do have.

As it turns out, we have not been waiting around for the signal. We are just starting year four of a multiparty partnership, in developing effective strategies for managing the spruce budworm. This study is funded by the Canadian Forest Service, the Department of Natural Resources and the Ontario Ministry of Natural Resources. It has the interest of the Spray Efficacy Research Group. Virtually, every manufacturer of budworm pesticides have put money into this. We have a long list of partners and participants in this. But, interest is waning.

The further you get away from the last budworm outbreak, it is like starting to get to the point where it is like pushing a wet noodle uphill. It is getting harder and harder to do, and it is getting a sight harder to track down the research dollars to keep it going and to do it. This study has broken down into five key components. We broke it down into this, so that there would be bite size understandable chunks. These components are IPM strategies, basically taking B.t. and pheromone or taking pheromone by itself or any other combination leading up through here.

The other four components are monitoring of low level populations, the decision support and strategic planning, the improved spray control systems, and the development of new products. These are all on-going things. We have broken them down into this, because we felt that some of these were going technologically a lot further along. And, they could be advanced into the realm of use a lot quicker than others could. Other components need a lot more work.

Some of the outputs of this have been the development and the transfer of the pheromone trapping system. It is an early warning system to the Department of Natural Resources and Energy (DNRE), and one day soon, maybe even expand to the Fundy Model Forest people. We are in the third year of validation tests for GPS integrated spray systems. A lot of this stuff is now available for use and it may get the acid test this year, not against the budworm, but against another insects. There is also the implementation of the Decision Support System (DSS) to the forest industry and into the province of New Brunswick, and basically for all the landbase. With regards to the development of new B.t. formulations in the last couple of years, there have been a couple more registered. We are working with the pheromone people to try and push this along and get it someplace. Like I said, it is like pushing noodles up a hill. But, at least we are pushing. We have something going, here, in New Brunswick. I think somewhere, it is going to have a payoff.

I would like to give you two options for the use of available pest management products that you would want to get later on. One of those options is Early Intervention. The other option is the best use of available pest management products like Mimic[®] or B.t., and eventually, pheromones and virus. You want to consider that and think of how you are going to use that, in an Early Intervention scenario. If it does not work, you can always go back to the old way of doing business. This would be doing it with B.t. Or, you can be proactive through the Early Intervention aspect of doing things, and it is possibly a new way of living with the budworm. But, it is going to take a lot of selling. What do we mean by Early Intervention? Is it population manipulation? On what scale can it be done? No matter which way you slice it, if you looked at it after Dave gets the stands all broken up, even to his most highly valued stands, you are still talking hundreds of thousands of hectares.

It does not matter. You are not going to reduce this down to fifty hectares. That is the size of the problem we are coping with. So, whatever you do, it has got to be affordable. The question is: where will the next budworm outbreak emerge? It is going to pop up somewhere in New Brunswick? Everybody thinks that it is going to be in a stand of balsam fir some place. What makes you think that? I would bet you dollars to donuts, which is not where it is going to happen. I would bet you, it is going to be in that mixed wood stand with big white spruce in it. This raises to Eldon's question of, why are these populations released from natural controls? Once they are released, how do we determine them in space and time? What do we do about it, contextually? Suppose this stuff emerges in the Saint John River Valley, where all the people are. That is a possible scenario. How quickly are you going to respond to it? Are you going to take the heat of the early warning, muster the troops and put together a good plan of action? Or, are you going to ignore it? That is all I have to say, Mr. Chairman.

Louis LaPierre: Thank you very much, Ed. Are there any questions? Comments? If not, than we are right on time. We can have a break and come back for the two final presentations of this afternoon, with Dr. Bernier and B.t. options.

We are in the final stretch today. I know it has been a lot of information, but I think we needed to put things in perspective. I think we have got very good context in which to continue the discussions.

The next presenter is Roger Bernier. Dr. Bernier will discuss the emerging trends in biotechnology in relation to budworm control.

3.10 EMERGING TRENDS IN BIOTECHNOLOGY RELATED TO BUDWORM CONTROL

Roger Bernier : Good afternoon. My presentation is entitled *Emerging Trends in Biotechnology related to Budworm Control*. It is divided in five sections. Firstly, I would like to discuss first-generation biotech products related to Spruce Budworm control.

Secondly, the second-generation biotech products which includes broader biological control agents (BCA) and bio-insecticides. I will then move to biotechnology and tree improvement, to conclude on short and long-term strategies to address Spruce Budworm control.

The first bioinsecticide, *Bacillus thuringiensis* or B.t., was discovered in the early 1900's. It was found associated with high mortality in silk worm rearing. Rapidly, microbiologists have identified a gram positive, spore-forming bacillus which upon sporulation produces an inclusion body or crystal. As we know now, the crystal contains a mixture of proteins which disrupt the digestive system of the target insect, causing mortality. The effect is limited to the larval stage of the targeted species; it does not affect adults or other beneficial insects such as dragonflies or honey bees. It is worth knowing that in Spruce Budworm control, spores play an important role in mortality through septicemia.

There are several advantages related to biotechnology-derived products. They are green products (meaning they are coming from natural sources) therefore already present in our environment. They are also completely biodegradable, and can be very specific (from several lepidoptera species to a single target, affecting only at one given development stage). Finally, they have a proven track record both in terms of efficacy and safety.

The first commercial B.t. product was already available before the Second World War. However, the product has a low potency, short shelf life, and the formulation (rheology) not very efficient. Also, the product would show tremendous batch variation in terms of potency and hence efficacy. The discovery of *Bacillus thuringiensis* strain HD-1 was a breakthrough, and provided a strain with much higher toxicity and stability. It was registered by the EPA in 1961, and has been used since in both agricultural and forestry outlets worldwide. With the discovery of HD-1 came a better strain characterization through flagellar and crystal serotyping, and DNA technology. This allowed a better quality control and environmental monitoring of sprayed B.t. products.

With further development in molecular biology and fermentation – to mention only these two sectors- several improved B.t. products were successfully launched. Other varieties of B.t. strains can be obtained by screening natural isolates for improved efficacy and/or stability, conjugation which represents a form of parasexuality common in bacteria, or the utilization of recombinant DNA technologies. Allow me to briefly describe each method.

Screening of natural isolates consists of harvesting and growing in laboratories thousand of natural B.t. strains from various sources – decayed wood, soil and water samples, dead insect samples, etc. Each strain is grown and tested separately against a variety of targeted pests. Most performant strains are further characterized and, when relevant, can be registered and used as new products. Strain conjugation is a form of parasexuality common to several bacterial species. It involves the transfer of particular genes from paired bacteria, including crystal-related genes.

During the transfer process, genes can undergo a rearrangement process call recombination, and can generate new genes with improved characteristics. It is completely natural – the microbiologist's role is to identify and cultivate the improved varieties. Finally, the discovery of genetic engineering in the early 1980's allows microbiologists to re-arrange genes to improve their stability, or products derived from those same genes.

Amongst second-generation products, I would like to describe new viruses, parasites and entomopathogenic fungi which all represent more choices in our way to control Spruce Budworm. Other improvements with B.t.-derived products came from a shift from oil-based to water-based formulations, better formulations in terms of dispersibility and fluidity, improved shelf-life, UV resistance and rainfastness, less microbial contamination (most often linked to better manufacturing practices), and higher potency allowing lower application rates or volume per hectare.

Recombinant DNA products are interesting since they overcome some of the problems currently found associated with natural B.t. strains. Let me introduce few examples of this technology.

Mycogen and Mcap technology, which consists of introducing and expressing B.t. crystal genes in *Pseudomonas* varieties. Gene expression is linked with the growth curve of the bacterium, allowing a better overall productivity. Secondly, the crystal is kept inside the bacterium as opposed to natural B.t. strains where the crystal is released in the environment. The bacterium cell walls provide a shelter to the crystal, allowing longer field persistence and hence higher efficacy.

The InCide technology consists of cloning B.t. crystal genes into *Clavibacter*, an endophytic bacterium, which colonizes vascular systems in plants. Same principle, the crystal is protected from the environment while providing its effect in terms of insect control.

Finally, recombinant-DNA technologies allow microbiologists to influence the rate of production of a given crystal gene by using stronger promoters, tandem genes, etc.

Future development in B.t. is related to the screening for more active crystal genes, for instance the Cry9Cal gene discovered at the CFS, Sault Ste Marie. There is a need to continue screening for more active and more specific crystal genes. There is also a need for a better understanding of Cry genes expression and regulation, especially if one wants to improve large-scale fermentation productivity. We also need to better understand the crystal-spore interaction in targeted insect/instar. Broader formulations for nurseries, niche markets and larger applications are also required. Finally, there must be a constant quest for improved formulation to broaden the application window.

Viruses are another sources of biological control agents. There are about twenty insect-related virus Families. Amongst them, the Baculoviridae represents the most important group. Granulovirus (GV) and nucleopolyhedrovirus (NPV) represent the best candidates for biological control. However, viruses are host-specific, and usually target only one species at the time. They are also known to cause epizootics within host populations. However, this is not the case with Spruce Budworm, due to its behavioral ecology, and therefore represents an obstacle for the use of viruses in Spruce control.

Finally, due to their mode of action and reproduction, viruses are slow-acting biological control agents which can represent a problem.

Viruses can be improved through DNA technologies. For instance, viruses expressing an insect-selective toxin or hormone inhibitor have been designed. Such a virus may reduce defoliation more efficiently than its natural counterpart, but may not be able to maintain itself in the target population due to its lack of reproduction. Antisens transcripts to block the translation of a protein essential to normal larval growth and development could also be used. Again, one would need to decide between defoliation and pest management. In either case, formulation and stability are challenging, and large-scale production is expensive due to living insect or insect cell line cultures.

Natural parasites have been found to be potential candidates for Spruce Budworm control. The best known case is *Trichogramma minutum*. However, parasites are usually good in complementing naturally-occurring mortality factors such as viruses or B.t., and represents tremendous challenges with respect to formulation, longevity and spray conditions. They may be of interest for some specific niche markets.

Entomopathogenic fungi, such as *Entomophaga maimaiga* against Gypsy Moth, represent another avenue. *Beauveria bassiana* has been extensively studied, but its large-scale production is difficult and can be very expensive.

Once again, formulation, shelf-life and application regimes are most challenging. With biological control agents, one needs to deliver a living product than can be easily stored, shipped and applied in a broad range of conditions; Furthermore, the product must persist long enough in the environment to be efficient.

I would like to move now to barriers to acceptance and growth of microbial pesticides. The first and most important criterion is cost. Biological control agents and bioinsecticides are expensive to produce, particularly viruses that require living cells or insects to reproduce.

Rapid biodegradability leads to repeated applications, hence higher cost of use. They are naturally sensitive to environmental factors such as UV and rain. They are slow acting when compared to traditional chemical products, and they have generally narrower spectrum. Finally, the regulatory status and public perception of recombinant-DNA strains are yet unsettled.

Lets move now to tree improvement through biotechnology. There has been severe limitation in the use of biotechnology for tree improvement mostly due to the relatively undomesticated nature of the crop, long time interval between generations, huge and complex tree genomes, more complex biochemical pathways and finally a lack of genomic tools. Fortunately, emerging technologies such as positional gene mapping may very well change this. It is an emerging tool in studying complex biochemical cascades such as growth, wood density and insect resistance. It allows the identification of gene clusters by looking at samples originating from founder populations and related families/offsprings. Linked with relational databases and other bioinformatic tools – such as linkage disequilibrium, identity-by-descent concepts, etc. – it may speed up the generation of new and improved trees. With respect to Spruce Budworm control, it may provide with molecular markers for DNA fingerprinting for rapid and early selections of tree progeny with enhanced natural Spruce Budworm resistance. Also, it would provide with selective addition/modification of individual traits related to Spruce Budworm resistance such as transgenic trees carrying B.t. genes, or over-expression or fine regulation of monoterpenes (produced by young trees) and showing anti-feeding properties against Spruce Budworm larvae.

I would like to come back to means to improve the efficacy of biological control agents and bioinsecticides. We, as a group, need to put more emphasis on a better understanding of all the biological factors involved in the ecology of Spruce Budworm such as insect/predator life cycle, insect and tree biochemistry and genomics, insect behavioural ecology, feeding activity, etc. We also need to consider other factors such as forest diversity and spatial scale. In terms of products used against Spruce Budworm, a stronger emphasis on fermentation and formulation (better rheology and applicability) is needed.

We were asked to provide this group with one short-term and one long-term strategy. With respect to a short-term strategy, allow me to suggest the following actions:

A strong financial support of existing research networks (CFS, provincial departments and agencies, universities, companies, Centres of Excellence) to continue their basic and applied research projects.

To provide the public with balanced, accurate and current information on the risks and benefits of biotechnology in forestry pest management versus the use of chemicals. Furthermore, we need to distinguish between biotechnology as a research tool and biotechnology as a mean to generate new products and services, so the public can understand and support our research initiatives.

With respect to a long-term strategy, we need to better understand all systems involved (biological and non-biological) and their interconnections. Finally, we need more research on tree genomics, including genetic markets for screening and diagnostics, and to better understand multiple-gene related traits.

Thank you very much for your attention.

Louis LaPierre: Thank you very much Dr. Bernier. Are there any questions for Dr. Bernier?

Blake Brunsdon: I was impressed with your talk Dr. Bernier. It is great to have you in the neighbourhood. I think you are going to be good for the team of expertise that we need to develop. But, you have not actually talked about the topic of genetic engineering. I wonder why?

Roger Bernier: I talked briefly about genetic engineering in the first five or six slides, when I said that there are different technologies. Mcap is one, InCide is one, and the third one, I could not elaborate on this one, because now that you all understand the gene structure and the gene regulation, why don't we work on that?

As I said earlier, there is still a perception that even though we are dealing with the gene from B.t., the gene has been around for quite some time. The promoter exists and it has always been attached to the gene. Because, without the promoter, you do not get gene expression. As soon as you touch it, people feel a bit sensitive. I think we need to debate that. What do we do? When we do that? Are we introducing new species? Are we crossing interspecies here? No, we are not. We are just improving like you would do on your car. You would bring slight modifications to make it more powerful. That is exactly what we are saying. We try to explain to the public what we are trying to do. I agree that there are different degrees of intervention. It is one thing to actually look at B.t. versus transferring a gene from fish to tomatoes. I understand and I think we have to debate that as well. I did not want to avoid the issue of genetic engineering. For me, it is trivial with respect to the science. But, it is not trivial, with respect to public information. That is going to be part of the discussion we need to have or part of the exchange we need to have with the public in general.

Louis LaPierre: I would have one question, if no one else has one. Do we have the qualified people and the expertise required to work within these products? For example, within our province, are we prepared to advance to this new frontier with our education program instructors?

Roger Bernier: We have two issues here: the current scientific background and the up coming new generation of researchers. Most of the information or most of the work that I listed here were from CFS and Canadian universities. In fact, we are leaders in that area. There is no question about it. I think we are established, and we currently have the technology.

Genomics is an issue that the entire country is moving towards. There are all kinds of efforts in Halifax, Montreal and in British Columbia. We are starting to get the critical mass together. There is no question about it. With respect to the future generations, there is no doubt in my mind that universities like UNB, Moncton and even Mount Allison are putting together new training programs to actually address that. The issue of manpower is a national issue. I do not believe that we are running out of good scientists and technicians.

I think the shortage in manpower or in people power is mostly towards specific new jobs, like regulation and management of small biotech companies, and things like that. But in terms of research, I think that we are on the right track. We just need to promote more exchange between those lead agencies and our universities. That should not be a problem.

Louis LaPierre: If there are no further comments, thank you very much for your comments. Dr. Bernier. I would just like to add an additional comment. Travelling through the United States not too long ago, I have seen an interesting book, *The New Natural Resource of the 20th Century Biotechnology*. It was quite interesting to see the opportunities for new discoveries.

Our final speaker, this afternoon, is Dave Davies. Dave Davies is with Forest Protection Limited. Dave will give us some indication on the status of our capabilities against future outbreaks. Our capabilities to deliver products across the landscape.

3.11 WHAT IS THE STATUS OF OUR PROTECTION CAPABILITIES?

Dave Davies: (The Montréal Canadians are going to win the Stanley Cup. You have heard it here, first). The topic that Nelson Carter volunteered me to present was the status of our protection capabilities against future outbreaks. Like a lot of the other speakers, I changed the title of my presentation. I changed it to *Back to the Future*. I am going to touch five general topic areas. These topics are aircraft and pilots required in the future, future navigation systems, weather measuring systems, application technology and future program cost. Then, I will come to two general strategic options that we should consider.

In the 1950's, Stearman aircraft were the work force of Forest Protection Limited and control programs in New Brunswick. The TBM's have been the work force of the 1960's, 1970's, and 1980's. In the 1990's, we have down-scaled to a more agricultural type aircraft, like the M18's. This is a photograph from 1957. We had over 200 Stearman spraying that year with a load capacity of 400 litres and a speed of 170 KPH. The TBM first came on line in 1958.

Its last operational insecticide spray program was in 1993. It has a load capacity of 2400 litres and a speed of 270 KPH. In the early 1990's, we started converting our TBM to fire bombers. They have turned out to be an excellent fire bomber. We have put in tanks, the Conair Design, from a British Columbia Company. They are equipped with the state-of-the-art technology. DC6's have also sprayed in New Brunswick for a couple of years. This is one example in 1998. They have a payload of 14 000 litres and a speed of 370 KPH. Some people will ask if you will ever use DC6's again? There is a map of the 1976 program, 3.9 million hectares. Will we ever treat that size of area in this province again? I think there is one thing that we should all agree on in this room. If we ever have to do that again, collectively we have been a failure. There is enough knowledge in this room to take steps to make sure that this never happens again. It had to be done at the time. But, does it have to be done in the future? I do not think we can afford it. I do not think, that environmentally, it is the right thing to do. I do not want my hair to turn white like Bud Irving.

In the 1990's, the M18 was a very popular aircraft. It is relatively inexpensive to purchase. It has a good payload of 1500 litres and a speed of 180 KPH. Our last operational spray program was in 1995. We did that with two AgTrucks with a payload of 500 litres and a speed of 180 KPH. If you notice the specs on that aircraft, they are very similar to the Stearman, which we started with in 1952. The only difference is that the aircraft is equipped with radar altimeters and DGPS data loggers. It is loaded to the hilt wit equipment for research projects and similar types of things.

We need aircraft for the future, the year 2000 and plus. AirTractor 802 is an American aircraft. It has been produced for the last year or two. It has a good payload of 3000 litres and a speed of 240 KPH. It costs over a million dollars.

It does have the advantage that it is a dual roll aircraft. It could be operated on a budworm control program in the morning. And, the next load out could be fire retardant. Some people think that aircraft should be dedicated to either fire suppression or an insecticide or pesticide program. I believe, with some degree of risk management, that aircraft could suit both roles. We should not rule out anything. This is what they call a Girid Chopper.

I would say that it has a payload of two litres, but it is probably whatever the pilot can carry. It has a speed of zero to ten KPH. It probably costs a couple of hundred bucks and a used lawnmower engine.

I did a quick review of the CAAA, the Canadian Aerial Applicators Association Directory, and then from people in organizations that I knew did not participate in that organization. My guess from Ontario East is that there exist about forty spray aircraft and thirty pilots with experience. If you look at the number that may be required for the next control program, do we have a sufficient quantity of aircraft and pilots? We are doing a tussock moth program in Nova Scotia. We are going there with a consortium of about twenty spray aircraft. But, we are having a real hard time finding pilots.

The second general topic is block navigation systems. In the 1950's, pilots were generally just given maps and told to go treat certain areas. Sometimes, there would or would not have been a spotter aircraft above the spray aircraft. In the 1960's, 1970's, and 1980's, FPL developed an aerial flagging system that consisted of Cessna 172 type aircraft. It flew above the spray aircraft. The spray aircraft used them as a pointer system. There were also some trials in the 1980's, on the Loran navigation, and INS navigation. The 1990's were really sold. I think that has been the biggest breakthrough, in aerial application on Differential Global Positioning System navigation, on aircraft. In 1998, in Nova Scotia, we will be using an Air Nav System. As I speak, I know we have a navigator flying over some Nova Scotia blocks, who is not saying kind things about some of these systems. We are trying to check out our DGPS signals down there. This is just an example of a picture from the 1950's of some pilots who are probably arguing over who gets to spray the closest block. I think back then, they were paid by the load. At one time, they received their loads, and they drew them out of a hat. This is what we have been using, from 1996.

Onward, is an aircraft with a DGPS system on board. It gets its GPS signal from four or more satellites. Then from here, we purchase the differential correction signal from another. There are two companies in North America that offer that signal for about 800 dollars per receiver per year.

These companies are Land Star and Omni Star. You can learn a lot by spraying with that. This was a block done in 1993 with the DGPS system. It shows the boom off, for a river. It also shows where we missed a spray line. That system is really based upon a light bar in a cockpit. There are also series of lights that tell the pilot whether he is on centre line, whether he is too far to the right or too far to the left. These lights will also tell the pilot when to boom on, and when to boom off. The technology is also out there now for the DGPS system to control the boom's on and boom's off. They would automatically boom on and boom off. All the pilot has to do is spray the lines. The day these systems get rid of pilots, is the day I am going to crack open a bottle of champagne.

The third topic was how do we measure weather conditions? We base this on the Environment Canada forecast. There is the Beaufort Scale of winds. This scale really depends on looking at smokestacks, bodies of water, how choppy they are, road dust, and how certain type of foliage is moving. In recent years, ground meteorological stations have also been set up, especially for research plots. In the last year or two, there is a system out called the AIMMS 10 System. AIMMS stands for aircraft instrumented meteorological measuring system. This is a picture of a meteorological station on the ground. That is a good system for giving you the ground weather. But, it does not necessarily give you the canopy weather conditions over a spray block. It does not tell you whether there is an inversion, how far up it is and the stability factors. The AIMMS 10 System consists of two units. The first unit is an instrumentation package that also contains DGPS. It will measure humidity, temperature and wind speed. The second unit is a radio. It will radio all that information directly back to the airstrip. This is all self contained with a battery pack that runs for about eight or ten hours. Generally, we would go over a spray block with this. On this slide, you can see the trials we did in 1997. We gathered weather information and we did a steep climb to gather stability conditions to see whether there was an inversion layer. All that information was sent back to the airport before the spray aircraft were released.

Application technology is another topic. This includes how did we make some changes in ground equipment? This also includes some of the atomizers that might be available and some of the data logging systems that are on our aircraft. There are several Decision Support Systems.

I know some of them have been mentioned today like PROPS developed by Dave MacLean. He explained that there are BioSIMS out there, developed by Dr. Jacques Régnière out of CFS Québec City. GypSES is a US Forest Service Decision Support System that has come on line the last three to five years. That is a system that combines a spray deposit model called AgDrift, with DGPS on the aircraft and the real meteorological conditions along with GIS data. I will get into some target optimization techniques that we tried in 1997.

Back in the 1980's and early 1990's, when I came along, we were in a system of tank farms. At one time, we had thousands of drums of pesticides being delivered that had to be triple rinsed and sent back somewhere for recycling. In the last couple of years, we are using mobile mixing plants and re-usable mini bulk-containers for our pesticide. This is sending all the containers back to the suppliers, where they belong. Some of the atomizers we have used in the past are Tee-jet nozzles. They have a spray speed of 270 KPH on a TBM that would have a VMD, (which means volume medium diameter. This means that 50%, of the volume sprayed would be above that diameter, and 50% of it would be below the diameter) of 80 to 120 microns. I think there is a lot of debate on what is the perfect size droplet. It certainly depends on pesticide formulation. But, it would be somewhere in the range of 50. This would be ideal. Micronair AU 4000 is a very common atomizer right now on agricultural type aircraft. Due to a speed of 180 KPH, it has a VMD of 70 to 90 microns depending on how you set the blades and on how fast they turn. It is too bad that Dr. Picot from UNB is not here to see a picture of the Convair. This aircraft was developed and used operationally very successfully in 1993. It created a VMD of around 40 microns at 14 000 RPM. That is a constant speed atomizer. That technology was very acceptable. But, it is just sitting on the shelf, because the next step is to redesign that atomizer to make it a lot lighter and acceptable for aircraft.

Another issue is target block optimization. We are optimizing the target deposit on the block. Basically, we would use a spray deposit model, we would use multiple line spraying outside the block boundary, and we would back off the spray lines in the downwind side of the block.

That would require linking real time weather conditions to a spray deposit model, and then, to a DGPS system. We tried this in Ontario in 1997 using the GypSES Decision Support System to coordinate everything. On this slide, you can see the Mimic[®] block that we had done. I think we did five passes outside that block. There is one line outside the block, and then we backed off five lines in the downwind applications. That gave a deposit. The emitted rate was 70 grams AI. That gave a pretty uniform deposit across the block, of about 50 grams AI. We are still light on the ends of each block. That was a boom-lagging problem that we are pretty sure we could correct in future applications. If we would run multiple lines across that block on the upwind side of the block, we would have under-applied it substantially. And that relates to more drift. This block or target optimization applies only to small blocks. If you look at the table in the total deposit, you could see that the optimized application method led to an average of about 40 grams AI per hectare versus the normal method of doing that, that is 30 grams AI per hectare. That gave an increase of 30% on the block. I guess, you could say 30% less drift. It gave about the same in number of drops per square centimetre. It gave a 30% increase, by using this new type of application technology.

Another issue is the future costs. The 1990's have been dealing with fifteen to twenty-five dollars per hectare. Dave MacLean mentioned a number this morning of 120 million dollars to do a 4 million-hectare program. I would venture to say that it could cost several hundred million dollars. Why is our cost going to double, triple, or quadruple in the year 2000 and plus? In the 1980's, we had three products and four suppliers. Now we are down to one definite product, and that is B.t. And another, I call it half a product, Mimic[®]. I think Nelson Carter's quote on it, was it defies logic, its results, and it acted like a feeding promoter. We have one-and-a-half supplier. We have the company Abbott Laboratories that is supplying B.t. We are limited in aircraft, and we are limited in pilots. So, when you are limited in something, they can pretty well name their own price. We have also gotten out of what I call UULV, Ultra, Ultra Low Volume Applications. In the early 1990's, we were putting out half a litre a hectare of this. That was used in some of the highest potency B.t. products that were available. That product has fallen by the way side, because it was only bought by New Brunswick. You do not get suppliers manufacturing a product, unless a lot of people are buying it. In Nova Scotia, the application rate is very high.

BIU's were putting out four litres twice, that is 8 litres total per hectare. Possibly, some of these volumes could be decreased on small blocks by using that target optimization technology I previously went over.

I am going to bring forward future strategic options. From my perspective, I look at two options. The first strategic option is future aircraft. I believe that FPL, DNR, and the forest industry should be the lead agencies on that. I believe that some time by the next mid-decade, our TBM's are going to require replacement as fire aircraft. I think that it is time to start looking at dual role aircraft, whether you buy them, whether you lease them, or whether you contract them. It does not matter how you get them. But, to bring something like that on line, people should start looking at what we need for the future, right now. There is a shortage of pilot training programs. We had proposals before the Environmental Trust Fund to set up a curriculum for spray pilots. But that got turned down.

The second strategic option relates to technology. There is a lot of technology out there right now. I think it is time that we made a decision to either start using the technology we have or just scrap it. Dave MacLean's PROPS decision, the Decision Support Systems, BioSIMS, GypSES. Those are three DSS; that have been out there for a while. We have to start evaluating those and decide whether we want to keep them, change them or use them. A lot of the agencies that are noted on this list have not been mentioned. It is hard to chose one lead agency. I have left some names out like RPC and the universities. There is a whole combination of people that have various degrees of expertise in all that application technology. But, it comes to a point that we just have to learn how to implement it. I think we are at that point, right now. We are going to try a lot of this new technology operationally for the first time in Nova Scotia. That should provide us some insight on how we are going to use it. I always wanted to be a guitar player, which might be the closest I will ever come.

Louis LaPierre: Are there any questions? Comments? You are a quiet bunch. Yes, Nelson and then Blake.

Nelson Carter: It is only natural that I do ask you a question, being the last speaker on the agenda. It seems that you took my name in vain like many other speakers here today. I was only the messenger. Louis was really the one who ask me to do it.

Dave Davies: Louis had the guts to send us a letter saying thank you for volunteering.

Nelson Carter: I guess he thought I could get you to volunteer.

You talked a lot about the aircraft, the equipment and so on required to carry out an effective program. If we need to mount a program requiring twenty to a hundred small aircraft, where do we stand with respect to airstrips and so on, to be able to handle that kind of air fleet?

Dave Davies: I think generally, the infrastructure airstrips have been kept up. Even airstrips that have not been used in a long time. Like Budworm City, there are Directors (of FPL) out there who make sure that those airstrips are kept and maintained as emergency airstrips. I think the Crown timber licencees in this province have accepted some of that responsibility. So, I think that if you looked at the airstrips scattered throughout this province that could handle small spray aircraft. I do not see that as a problem.

Blake Brunson: Dave, you mentioned the aircraft AIMMS 10 System which is an aircraft monitor or a weather system. Is that a research tool? Or, do you consider that operational? And, if so, are you going to be using it in Nova Scotia this year?

Dave Davies: We sort of made a decision on that today. We have listed it as an option, and they did not seem interested. But, I think we are going to proceed with using that. It was developed by Avionics in Toronto, and he says the Americans are just grabbing these things up. The fire people, especially in Mezzula Montana and in southern Québec, are very interested in one of these systems. They cost around 40 000 dollars. I consider them operational. It is just a matter of buying them, sticking them on the aircraft and using them. I think we will be using them. We will find a way to use one in Nova Scotia.

Louis LaPierre: If there are no further questions, I would like to, first of all, take this opportunity to thank all the speakers. I think they have been very thorough, and they have mostly done their homework in giving us some very fine points to ponder as we go into tomorrow. I think they have focused to where we must start. I would like to thank them for having accepted. Nelson and I worked this tagged team on this. You see those tagged teams with wrestlers, they are both bad guys, but one guy will ask, and the other guy goes to sit down. We have all the speakers lined up, and we have got our act together. When Nelson said he was going to call, I said I was going to send a letter thanking them. So, that is how we got them all coerced. Thank you very much for accepting. We know that you are all busy and that you all have other things to do. I think it is a very important debate that we are going to get started in New Brunswick. I think now is the opportune time to start it. The Premier's Round Table certainly thanks you for the information that you brought forward. We will have the benefit from the tapes. All of the presentations today were taped. We will transcribe those tapes and we will make them available to you. The final document on the last meeting we had in November has gone to the printers. It has over 300 pages of information. It should be available in a couple of weeks. It will all be mailed to you. We did send you a quick draft when the meeting was over. But, the final document will be mailed to you in a few weeks. We hope to do the same thing with this one, and forward it to you. I would ask the people who have used slides or those who have additional information, that you please give them to us. We will have the benefits of your speech, but we will not have the benefits of your slides if you do not give them to us. We have included the slides in appendices to the first presentation. We would like to do the same thing with this one. I would ask that you give us your slides before you run away tomorrow. Now, I would like to ask Wendy if she would care to answer the question that was put forward to her in one of the presentations this afternoon.

Wendy Sexsmith: The question was, what are we doing with PMRA as a regulatory agency with regards to this issue of endocrine disrupters. I will back up a little bit and talk about what is meant by an endocrine disrupter. First of all, most people probably know that the endocrine system is really a series of glands and organs in mammals, birds and fish. They essentially create chemicals that elicit physiological responses. Those chemicals are often referred to things like hormones.

This is just to give you a bit of a the background. The second issue is, what do we do know on the regulatory Agency? That is in our normal data requirements and in our review of them. We are looking for things that are being referred to as endocrine disrupters that are essentially hormone mimics. They will mimic the normal hormone in the process and cause its disruption. Through our normal evaluation process, through the reproduction studies, through the field studies and through various short-term and long-term studies, we look for that. In fact, if there are any signs, we will ask for additional studies. However, there is no question that this is an area of concern. I think that to be absolutely up front, this is an area of concern for the developed countries under OECD that are looking at this issue broadly. As a country, we are working with the US and all the other developed countries to ensure that. We are asking the right questions to be able to be absolutely sure that we can pick these things up. Then, we are looking to develop appropriate or additional protocols and/or data requirements. That is the second part of my answer. The issue of the international work in this area, is ongoing. It is a big issue in this area that I am talking about the Pesticide Forum. We are looking to either make sure that we are doing the right thing or make changes, if we are not doing the right thing. That is sort of the long and the short answer.

Louis LaPierre: Are there any questions for Wendy? Are there any questions to any of the other presenters? Are there any comments on anything that you have heard?

Bob Thompson: I do not have a question, I have a comment. I will try to keep it as short as I can. My name is Bob Thompson, I live in Musquash. I have 300 acres of woodland, and at the present time, I make my living off that woodland. I have been around the woods for about forty years, so I have seen quite a few changes. Today, I represent SNB, the Forest Product Market Board. I chair that Marketing Board at the present time. The SNB Board runs from Hopewell Cape to Point Lepreau, and from the North to Grand Lac. There are 6000 woodlot owners, and there is a Board of sixty Directors who represent those woodlot owners. There is also an Executive Board of nine Directors who meet every month, to deal with the day to day situations and problems. Last night, as Chairman, I called those nine Directors to see how they felt about the budworm situation, because I was coming here today. I was surprised at the reactions I got.

Five Directors of the nine totally disagreed with any type of chemical insecticide spray. Of the other Directors, two were young fellows. They said that they did not like chemical spray, but they had not been around when the last budworm outbreak was here. So, they did not know enough about it to make a positive decision. One Director was a large woodlot owner and a large contractor. He said that he felt that he did not like chemical spray, but if it came between him and his woodlot, he might make a different decision. I feel that to take the direction of any type of chemical insecticide spray, that would be a serious problem for us as woodlot owners and wood producers, including the industry. If the woodlot owners themselves feel that way on chemical insecticides, imagine what the general public feels like. So, there are a lot of other areas where we can work in to overcome the budworm situation.

We can immediately start changing our way of harvesting. Today, I noticed in a lot of the charts that the main problem with the budworm loss is balsam fir. We could make that a priority and make sure that the over-mature and mature balsam fir is cut as soon as possible, and kept cut as we go along. There are a lot of things we can do. But, I do not think we need to get into a pesticide type spray. I think B.t. sounds okay, but I do not know enough about it yet. I would like to have more information on it. I think we might be able to use something like that.

Louis LaPierre: Thank you very much for your comments. Are there any more comments or questions? If there are no additional questions, than I just have a few comments before you take some fresh air. We have a supper provided this evening. We had originally planned to have a speaker. However, some of the committee members thought that maybe we would have information overload. So, we needed a light speaker for this evening. We have the new Premier as a possible speaker. However, he is very busy and involved in discussions right now downtown. So, I will have to check to make sure that he is available. But, that is the tentative speaker. It will not be an overview of the interactions of insects and forest dynamics. After the supper, I had decided to work, so we would have a meeting. But, most of the committee members told me that I was a bit off my rocker. I guess Dave convinced me that this is really not the thing to do. There will be no meeting of the panel members tonight.

But the other side of this, and I was trying to be democratic, I thought we would all get together and you could choose the topics that you wanted to work with tomorrow. We are going to do this in an organized democracy. We have already put you on a slate of work-teams for tomorrow. They will be posted tomorrow morning outside here as you arrive. Then, the facilitators will meet following this, and they will select the topics that will be assigned to your group. That is a great choice that you will have to make. You will have to go to a group with the topics already predesigned. Looking at the issues, we have asked each group to come up with two. But if you can do your homework faster, you can come up with more than two subjects. You can comment on as many as you want. Your comments are not limited to two. But, we think that in the time that you have, you may not be able to do the work as we have identified it with more than two subjects.

Some of the speakers have done a very good job in focusing on what they want. If you agree with what they have said, your work can be done. You may be able to do two or three of the issues. Hopefully, you can get some issues and debates on how we would like to move forward. We would like to have as much information as possible to bring back to the Round Table, not only topics. How can we address these topics? How can we move these forward? As I told you this morning, we hope to have, by the Fall, a meeting with the Premier and Cabinet, to put these issues to government for support in a strategy. So, this is a commitment from the Round Table. Certainly, I want to thank all of you who have participated. It will be helping us to put this forward. Unless someone else has any additional comments, I would ask the facilitators to stay here with me. The rest of you can go and enjoy the fresh air until suppertime. At 6:30, we will have a reception outside here.

4.0 RECOMMENDATIONS FROM THE BREAK-OUT GROUPS

Louis LaPierre: All the presenters think they did a fine job, so we should have a fine report. I would ask Alistair to start.

4.1 GROUP 1 : INFORMATION, EDUCATION AND PUBLIC INVOLVEMENT

Alistair Bath: For starters, our group was really energetic. We had a really enthusiastic group. We figured there would be some good discussions and maybe some controversies about some of the things we were talking about. So, we organized our ideas using sort of a European card system in terms of facilitating. The first shade is just a set of discussion rules. It will help you interpret what we actually did in the flow of discussion. We started with some discussion rules that would just help us to find this flow of discussion. Thirty seconds was the speaking allowance, because we did not want any monologues to occur during the discussion. We were going to write down all the ideas and we were going to express each idea on a card. We had one idea per card. We did not want to have just key words on the card. We had to have an idea expressed by that card. If somebody had an objection to that card, that was called a flash. Enthusiastically, we got into this. We were behind closed doors, so it was okay. But, Ed's group beside us, heard us. The flash is a red arrow, and that will give you an indication that there was some discussion about an idea that occurred. Then, if you follow that red arrow, you will see ovals. The ovals are the flashes or discussions of some of the key ideas. In our group, we also stressed that saying yes while really meaning no, just leads to more problems down the road. It is better to have that discussion and generate a little bit of controversy, than produce something that at the end of the day, we are not that sure about.

We started with information, education and public involvement. That was our initiative. The purpose for this workshop was to develop a coherent strategy to promote forest protection and control of spruce budworm. We just generated a couple of ideas of control budworm meant to protect.

The first issue is to promote forest protection. A couple of discussions from yesterday suggested that we really are protecting timber supplies. But then, we also captured some ideas from Dave's presentation that the non-timber values and protected areas are also important. The first question we started with was is this a priority issue?

We found that it is a priority issue, because sometimes the media will be misrepresenting it, and this can happen really quickly in terms of the Internet.

The public tends to fight our efforts. There is a lot of misinformation and inaccuracies out there. We need more informed and better decisions. There is a need for informed decisions. Then, there is some discussion that maybe not everyone has to be informed, and that education is a continuing process. The discussion revolved around the idea that just because you inform people, this does not mean you are going to change attitudes. Maybe you need to learn more about what kinds of pieces of information to give and the values around that. We have to look at all potential impacts like social impacts, economic impacts and ecological impacts. The public is getting more a right to know what this information is about. That is a reason why this is a priority. Better policy will result if we do address information education and public involvement. The public will demand more unbiased information and involvement as a resulting idea. There is going to be a budworm outbreak at some point in time. So, we better start thinking now about the importance for future generations, and the need to avoid crisis management. We are trying to get a sense of why public information and education is important. If we understand why it is important, then we can start identifying what the problems and the issues are within these things. That is what the next three issues are addressing. This question of what are the problems or issues within each of these priorities?

The group came up with nine different problems. First, we recognized a problem of public participation in the government role. The government does not recognize that public input is as much important as industry input. They do not tend to involve the public. As you can see, that generated few flashes and a few discussions that industry is listening through public participation. Then, that was generated and it was said that the industry could choose when to participate and who will participate. Under the goals and objectives of government, they give that responsibility to the industry. Maybe that is not quite fair. The government is changing though. Public participation is a reality. So, how do you include or use this information? How do you make this thing happen? These were all resulting discussions from this comment. We labelled that public participation and the government's role.

Another problem is about funding. There is a lack of research funds. The more you move further away from the problem, the more distant and the tougher it is to find research funds. Then there were some comments about the fact that you need to have the environmental groups there to support this basic research, and get them on-side.

The third problem here is how should we send the message? Who is going to be the messenger? How do we select who presents information to these various publics? We need to have a credible presenter. Again, that generated a lot of discussion on the fact that it should be unbiased. Maybe it is not an individual, but it is a process. Perhaps we are looking at something like a policy advisory process or a group of individuals. Other things that were linked with this problem was, what is the appropriate form to inform and educate the public? Maybe we should get away from this wording of inform and educate. Maybe we need to learn to respect other opinions. That comes through to when we talk about the government. Again, in terms of respect, trust, and credibility. Changing opinions may not even be possible. Again, we are emphasizing the importance of respecting rather than just informing. We need to have some group in place as a constant group participation, so that you are addressing this. Currently, the lack of this, is what the problem is. The fourth problem is general awareness. There is a lack of public knowledge about all these various control methods and control options. There is also a lack of public knowledge about what exactly spraying is. There is a real sensitivity to spraying issues in the forest. That is probably because of past personalities and credibility issues. That is all tied up with this awareness question. There are a range of options that need to be communicated. There is also the need for managers and decision-makers to examine all management options. We do not just have to look at spraying, but we have to look at all kinds of different possibilities with the discussion. On the final page of what are the problems and issues, and this came out of Wendy's discussion yesterday, is a lack of understanding and confidence in the Federal Registration System. Being informed does not necessarily change the process. We label that as a confidence and a bureaucracy problem.

There is also a need to share success stories. There are actually some positive things that have happened. We need to learn from the past experiences and get them.

At the moment, we have intended to do that. That is why it is a problem. We have to communicate that better. A lot of decisions are made on emotion or on lack of emotion. We labelled this set of ideas, emotion. There is an initial comment of the lack of provincial pride or interest or importance in forestry. Then, there is discussion that maybe there is some awareness, but politicians need to become more involved. There is discussion that maybe there is a lack of emotion in the public towards the forest. Then, there is considerable discussion that definitely emotion does exist. The group beside us, Ed's group, can probably attest that there was emotion in our room.

The final problem here, is on respect. The forest industry cannot force their views on their public, then generated discussion and say it is not just the forest industry. Everyone has different views that are trying to be forced on the public. We have to be more credible than that. The credibility issue comes up. It has to be sensitive to values and other kinds of issues related to sharing different viewpoints and gaining trust. The forestry equals public dollars. Because, you are dealing with an issue that is publicly funded, there tends to be more reaction.

The group brainstormed on all of these different problems. Then, we labelled these problems and we grouped some of these cards together. We generated these ideas, we moved them all around, and we grouped them. Then, we prioritized them, and that is what these little red dots are. The issue that came out as the top priority or the issue that this group would like to send for discussion, is the one on awareness. How did this come out? The members of the group were asked to put dots on the issues, to prioritize them. The topic of awareness came out as the issue of highest priority. We have to look at awareness. The issue that came in second was to look at the how. How are you going to implement it? This received quite a lot of votes too. This group worked really hard, and it had me working really hard.

We made all the cards during the exercise. All the cards were made during the discussion. So, the group got a lot done. The final issue was our "how to" question. How are we actually going to do this? How do we do this? We need some sort of interdisciplinary committee that will report to the Provincial Round Table.

The role of this committee would be an advisory group that would start looking at the details, start flushing out these problems and getting to the specific messages. What kind of messages in terms of, what should be communicated? It was also felt that this committee should have some sort of research mandate, so they can actually collect data. The logical first step might be in terms of, what does the public already know? And what is the linkage between public knowledge and beliefs? Maureen made the comment that before you start educating, you have to know on what level you are starting at. So, you do not shoot too high or too low or on issues that do not seem to be important or linked to attitude. The group figured that the time frame for this group was in the next five years. But, there was also some good discussion about how we have to move faster than that. Perhaps we need to stop creating more and more committees, because we need to get going and produce some fast messages. That was flashed as well. We also need a coordinated approach. We cannot just randomly go out there and communicate the messages. We have to try to get everybody on our side. And, this is as far as the group got. We knew that we also have to think about who the public is, but that is something that this group might do at a later time.

Are there any questions or comments? Did I represent the group's views, accurately?

Louis LaPierre: Thank you very much Alistair.

4.2 GROUP 2 : BIOTECHNOLOGY AND NEW CONTROLS

Ed Hurley: The first thing is that we are trying to answer three basic questions, why, what, and how. Why, being what kind of a message should this group define in aiming at the Round Table group? This particular group was based on biotechnology and new controls. I cannot remember what the group title was. We did not necessarily get off track, but we dealt with technology, biotechnology, new trends and tools towards an IPM approach, etc. At this point, we need to define what that means, in terms of this overall issue. Basically, the aim here is to control and prevent an outbreak, minimize the impact of spruce budworm on the forest of New Brunswick and the surrounding jurisdictions.

We definitely need more tools or a tool kit. There should also be alternatives to traditional approaches. This is some of the language that is in here.

I want to make a distinction between what we have now and what we will work towards. In our whole exercise, that was some of the initial thinking in this. What do we have now? Where should we be going? We need an application of tools. Our tool kit may consist of tools, techniques and methods. The idea is that the application of those tools within that kit is applied in parallel or in sequence. There is a strategy implied in that area. This concern in terms of control is what it imparts in the public's eye. Some of the flashes came up over here. Public perception and information is important. Social acceptance and sensitization to this whole problem of control and biocontrol are also important. The message that the group would want brought to the board, is that this is for the next spruce budworm outbreak, at least on the shorter term. Some of the things we might get into here, will definitely or maybe be on the longer term. But, the group felt that an immediate time frame was needed. We need to deal with the technology issue, now. There are also tools that are in need of testing and decision-making. There are a number of products sitting on the table. We have to get them past that point. Can they actually be used in the field? So, that is why the group felt that this issue needs to be dealt with in a very near time frame, at least to be addressed to the Round Table.

From that point on, we got into some of the limitations or problems that would arise in deciding what to do. The response is that we are dealing with some of those problems. We are also trying to do something towards dealing with the next spruce budworm outbreak in terms of biotech and that whole issue. The first thing that came upfront, and that was considered of the highest priority, was to establish a biocontrol network. A network is a model. I have put quotes on biocontrol network, because some of you will say that there is already one there. But, this particular network might be an organisation or a group. We got into a side discussion on whether this is a mandated organization that might consist of investors, universities, scientists, etc.

It is a model in terms of getting the right people together with the main objective to get new products to the market place. Some of the discussion centred on the fact that the current business climate is seen, by many, as a restriction to getting new products to the market place. So, how would you go about that? With a mandate, this group might be an incorporated network who's energy would be primarily objective to get new products to the market, as registered products.

Perhaps linked to this group would be a super expert group of scientists, probably chiefly scientists, to address all of the biotech tools, specifically whether you are talking about Mimic[®], whether you are talking about Neem, whether you are talking about other biorationals, etc. There are core groups of super experts that could deal with these things and consider the opportunities that are there, and how they might advance them. We did not get into details of how they would be linked, and in what way. But, I think of two separate entities that would be working together. In terms of some of the actions identified for those two groups, they would basically have a meeting. Not for the sake of having a meeting, but at least to form this group, they would have a meeting of stakeholders. The stakeholders could include investors, venture capitalists, suppliers, scientists, governments and users, etc., in general terms, to get together to set targets for new products. The energy would be spent on meeting a primary objective for these groups of stakeholders. That would be to get new products out on a fast track, and to do whatever is needed to get it out. Meetings are always fun and wonderful, but are you actually going to get anything out of it.

The second item is to set targets, and that is of primary importance to this group. You have to set the targets and push hard. Who is going to be the next Bioatlantic? You need someone to lead it. Bio Atlantech offered themselves the task of leading it and calling for that formative meeting, and then getting the show on the road. That is the first priority in terms of some organizational group without a lot of specifics. In general terms, the first action is to get together and to get the show in the road. The next priority, not of lesser priority, is the control products themselves. We had a long list of control products. We certainly heard those yesterday. Some of those products are registered, but perhaps not enough of them. The idea here is in terms of dealing with this issue of control products.

The action is to evaluate, and this will be obvious. But, we need to evaluate the potential of the product and continue the work on these products. I have listed several of the products that we heard yesterday for registration. These products need to be registered, so let's do it. We also need to continue to look for natural biocontrol agents. Do not let that little wheel stop, you have to keep looking. Some additional details might be, who is going to do it? What organizations will be involved? How are you going to go about it? I did not want to get into that layer.

I just wanted to identify this as a very important component or action in terms of control products. We have to keep looking for the magic bullet. We cannot stop.

That was the message. Just to remind all of us that the idea here is a contribution to an overall IPM program. So, these control products are not the only thing. But, they are part of a larger IPM project or strategy. In this exercise, I listed, as one of our option, to put together an organization that would deal with control products and the actions for that. And then, we get two application technologies. These things are all very intimately linked together. If that is not obvious to you now, it will be in a moment. That fell out maybe more by chance than design, but it seems to work well in principle, here. So, you deal with your control products.

Application technology was another major concern that should be dealt with and how you might action it. Again, this is very general. But, it is a parallel exercise to product development. You can not just say, here is a neat little product, and then, get it out there in the forest. That would work in parallel with the control products and any products for registration that can be identified by that team of experts to get it to the market. So, you see how these link. The primary action under application technology is to review the current application technology for registered products. There was some discussion about some confusing information or results about application of B.t. I think it had to do with potency and volume rates etc., how does it work? There is conflicting information there. So, we have to resolve it somehow or review it. This is a big task, but it is one that needs to be done. The objective is to optimize it.

Finally, last but not least, is to look at tree improvement and this overall picture again. Some discussion about tree improvement programs in the past and perhaps more recently, tend to look at tree improvement from the perspective of yield and growth productivity. To make sure that those attributes are looked at, is to make sure that any opportunities for pest resistance are picked up on. Sometimes that is implicit in tree improvement, but is it actually being done. There was some discussion on that. It was certainly considered and it may have been recognized in the past, but is it done enough as a strategy? The action might be basically to back off a little bit.

Yesterday, there was some discussion in the presentation about genomics. That we need a team for it that might start addressing some of these things. There is only a single action item, and it is the only one that needs money. That is a joke. I think that would rap up this team's summary analysis. I invite anyone in our group to add to my presentation. If I have done any disservice to this in recording the discussion, please help me out here or help the group. Are there any questions?

Louis LaPierre: You seem to have captured it all. Dean Toole, you are next.

4.3 GROUP 3 : MONITORING AND POPULATION TRENDS

Dean Toole: Our group looked at monitoring and population trends. We started our discussions with talking about the "why". Why is this an issue? Then, we brainstormed some the problems and the issues related to that. We went through a fairly extensive process on that. We ended up synthesizing them down into one general recommendation, and four main recommendations that we would like to come forward from this group to the government of the province. We synthesized them very specifically into these five topics. So, if you do not remember anything else, these are the issues that we want you to take forward. Then we have a number of background issues that come out of them. So, I will go through those. The general recommendation leading to all of this is that we need to make a commitment to an Integrated Pest Management Strategy.

That is what we have all been talking about. Obviously, our group ties very closely to the other three groups. As a follow up to that, we suggest that the issue be tied to the National Integrated Pest Management Strategy.

There are four different commitments that I have double slashed here. The first commitment is government commitment to the development, implementation and funding of a comprehensive sampling program, which reliably monitors population levels and trends. That is a statement we want to take forward. Under that, some of the things we have discussed is that we need to have a method of standardization. There is an entomologist side of the meeting of October, in Toronto. I believe Ed said that we felt that we should be part of that meeting or that we should have a lead in it.

There is also a Pest Management Forum, and there exists a Forest Protection Technology Committee. These were the organizations that should have input to make sure that there is a standardization of methodologies for sampling and to make sure there is a commitment. Brackets commitment, in our definition, means funding from the Department of Natural Resources and the landowners towards ensuring that this strategy is implemented or developed. We also should make sure that there is a commonality with sampling methods to ensure that the results can be comparable. That is within province and across jurisdictions. There also has to be a commonality in the reporting strategy. The other big issue is to ensure cooperation, coordination and compatibility with neighbours. We are talking about other agencies both provincially, nationally, and internationally. It was felt that the component of this should be institutionalized, and that someone should take the lead on this. As an example, we would suggest that the CFS Forest Health Network may coordinate this effort nationally and internationally to roll up this information and to make sure that we have a common effort in this run.

Our second recommendation is government commitment to the development and implementation of a strategy to protect forest resource values from spruce budworm. We are talking about all forest resource values. Components of that is an early intervention strategy.

Other things we have discussed is population suppression in selected areas that are part of that strategy. Another important point to consider is the understanding regarding the socio-economic impact of the spruce budworm on all forest values. Basically, we are talking about a risk benefit analysis. When the time comes, we have to make a decision of whether it is an early intervention process strategy. Then, we want to have the tools to make the risk benefit analysis, so we can make an informed decision as to where we go. There was one recommendation that we felt was fairly immediate and that it would probably go to the Premier's Round Table as opposed to the Cabinet. This recommendation was to host a workshop in similar format to what we have done in the last two days. This would be done to increase public awareness and to develop a strategy for early intervention. It was felt that we should do that with all the stakeholders, and with as many people as we could get to attend from all interest groups. This workshop would be on a two-day format. Similar to what we just undertook, it would include presentations in the first day to set the stage.

Then, the second day would suggest that we would look at the decision support models that Dave MacLean has put forward and developed for the province. You have seen the maps up there on the wall during his presentation. Through that exercise, we could work with the different stakeholders and show them potential impacts of an impending outbreak. We could also take that down to the woodlot owner level or to the particular land owned base level. So, people will actually see the impacts of the spruce budworm on as many forest values as we could do for that exercise. We would also be talking about forecasting those impacts.

The third recommendation is a government commitment to the development and implementation of a public education and public input program, regarding spruce budworm and its potential impacts. We are getting back to the potential impacts again. We want the public and the landowners to be informed. Then, they will be able to make an informed decision when it comes to making a decision as to protection and as to the level of protection. We suggest that things like education, public participation and raising of public awareness should be carried out by an unbiased third party.

Some ideas from the first presentation, suggested that possibilities for that role would be the universities, Fundy Model Forest, and the woodlot owners associations. Those came up as possible examples of people that could carry that message forward.

The final recommendation was government commitment to the development, implementation and funding of a research program in support of improving our Integrated Pest Management Strategy. So, those are the four major recommendations of our group.

Does anyone from the group like to add to that? We wanted to put forward recommendations that would be taken to the Premier's Round Table, and then to the Premier and Cabinet. Are there any questions? Thank you.

4.4 GROUP 4 : FOREST STRUCTURE AND MANAGEMENT

Louis LaPierre: Our group was the forest structure and management group. We started our discussions on why should we move towards a forest management structure?

The discussions focused on numerous issues. But, one was to reduce the susceptibility of the forest to budworm infestation. The objective on this would be to reduce the balsam fir component in the forest. We decided on that, accepting the fact that our forestry practices up until now had favoured balsam fir, since it was an agent in supporting the budworm. We have to move forward in trying to suppress our effects of management practices that have changed the forest structure. We have also managed forest insect populations over time. So, all of this has given us a different forest. We also agreed, from the discussions, that moving towards a managed forest structure would be more acceptable to society than spraying the forest. We also identified that it was certainly more in tune with sustainable forest management and that it could be integrated into adaptive management strategies. At the end, it should allow us to have a higher value for our forest. We continue with numerous other reasons as to why.

But, we certainly had a consensus that it was an objective towards which we should move. And we should move quickly towards it, because there are activities that we could start right away.

We started with the preamble and we arrived at three basic components of our strategy. The first component is that if there is more balsam fir in the forest today than in pre-settlement conditions, whatever management plan is put in place needs to respect the natural disturbance regime. We looked at activities that could be undertaken. The first part of our recommendations was that we should look at operational activities that would tend to reduce outbreak severity. Most of these operational activities could be short termed and started right away. For example harvesting strategies, with the objective to reduce balsam fir, could be integrated very quickly into management plan. Following this activity, you could include silviculture. The safe concept could be silviculture thinning and planting activities. Then, the management-planning objective would be to reduce balsam fir across the landscape level.

The planting of trees supports the objective of reducing balsam fir. These are all short-term operational activities. Some of them have long-term implications, but they could all be started today. These were all things that we could do.

We have also identified, as other groups have, that we need to have a policy structure to support these objectives. There is a need in New Brunswick, because of the overall dependence and contribution of the forest to our economy. The province of New Brunswick, more than any other province in Canada, should have a policy statement. A policy statement that would place its new forest management strategy for the 21st Century. In this policy, we would incorporate the intrinsic values of the forest, which means that there are other economic values. The forest certainly has an economic importance and that should be stressed. A strategic direction and a vision statement should be put in place in this policy. The research and funding agenda should be identified. We should clearly define the protection policy for both timber and non-timber value, so that we have a framework from which we can work from. We have the importance of this policy. This policy could then be forwarded to some central government agencies.

For example, there is a priority in place for New Brunswick. For once, New Brunswick has a priority, which is the development and maintenance of its forest within a strong economic development for the 21st Century. We have also identified that in order for this to work, there needed to be an advisory working group to DNRE. This group should be multi-stakeholder and I think a few groups have already identified this.

There is an importance to feed on a continuous basis that the opportunity for dialogue needs to be developed. You need to have an opportunity to share your views and an opportunity to debate them within structure, within science, and to see that they will support it. There is an opportunity for the public to support integrated pest management options. The group thought that there was a need for incentives to accelerate. For example, as short-term, we could put in place true policy incentives to accelerate the harvesting of balsam fir and promote more abundant species. We did not identify what we meant by abundant species, but we can look at pine, spruce, red spruce, etc., and the structure of trees that were there in the past. To do this, we had some specifics, so we could reduce stumpage on balsam fir for a fixed time period in which to allow that conversion to take place. We could encourage the plantation of red spruce, white spruce, and white pine regeneration through shelter woods. We could build a balsam fir management option as a requirement in the next planning cycle with the objective of reducing balsam fir across the landscape. The incentive should not be given, unless one agrees to include C in the process. You get no incentives to cut the balsam fir on stumpage reduction, if you did not agree to include a long-term management of balsam fir across your land. We need to use pre-commercial thinning to support the policy of reducing balsam fir. So, we looked at some of these issues.

A third component was research. Within the context, spruce budworm biology and impacts about attractants are very important. We wanted to test an attractant, specific stand and forest level variations on spruce budworm populations and the impacts on trees. That would take it from low populations to have a look at the overall structure, how structure defines the population? And then from that, the objectives would be to identify and define pest management plans at the stand level. We would need to define and plan activities at the landscape level.

The opportunity to do that was now while the populations were low, so we could move forward. We can also look at some indications of tree genetics, biological control, parasitoids, and the importance of structuring partnerships or leverage of funding, particularly at the granting agencies.

We have also identified an issue that was outside our mandate, but of importance. We did not have this to consider. But, we need to structure a process to bring to society the message of integrated forest management, the new forestry for the 21st Century. Within that strategy, we must focus on ensuring that the public understands what integrated pest management is, what the new forest structure is, what are the research options, and what are the consequences of budworm outbreak and of other insects within the forest management structure. We also want to relate these consequences to the social benefits or the social problems associated with economic and ecological problems. Who should be involved in developing this? I think everyone here is quite comprehensive, and no one should be left out. I think we have them all here. So, this is what our group has focused on. We focused on three basic issues to try to move forest structure management across time. And, it becomes an important issue to move forward. Does anyone else from our group have anything to add. Maybe, Dave Oxley.

Dave Oxley: I think we should thank the young lady who did all the work for you.

Louis LaPierre. I am going to do that. That is right, she did a fine job. We did not have to use your rolled up paper. Dave was in charge of putting the information on paper, and he did a fine job. They are all rolled up here, in separate groups: one is red, one is blue. We know what the blue is and what the red is. Then, we had the benefit of having someone take notes for us. So, our notes are already in the computer. I just wanted to check with Dave. Dave MacLean do you have anything else to add?

Dave McLean: No, thank you.

Louis LaPierre: Does anybody else from our group have something to add? There is a question in the back, Max.

Max Cater: I would like to make a comment. I do not know if you ever watch the Air Farce show or not, but every once and a while there is an old fellow who comes on there, Dave Broadfoot. He says that he is old enough, now, to say what he wants. That is about the stage I am in. You are talking about the provincial trees of New Brunswick and you are trying to eradicate it. Secondly, this thing that Mr. Coon talked about yesterday, in 1920, that we had an opportunity in 1920 to change things. In 1920, the whole Big South area had blown down. The trees had been killed by budworm from 1916 to 1920. The Dean of forestry at the time, was up there and there are pictures taken of it. In 1975, there was a provincial forester by the name of Jack Pinder who had made a management plan for the Big South area. At the time, the Big South was part of the Bathurst timber license or part of the Bathurst Crown Reserve. We were to log 160 000 cunits off that section of the Big South for ten years. That was 1.6 million cunits of wood which was primarily balsam fir that all originated from the budworm epidemic of 1916 to 1920. That covered a large area. Now, in Northern New Brunswick, Gaspé Coast and Western Newfoundland, balsam fir is in his optimum range. It is not in its optimum range in the Yukon, in the Labrador or in southern New Brunswick. But, it is up there, and it is a big part of our territory. That is like the breadbasket of wood supply for Northern New Brunswick for the future if it is managed properly. But, it is not going to be managed by trying to remove the balsam fir.

As far as I am concerned, that is like saying do not buy any more weed kill at Canadian Tire, because we are going to pick all the dandelions out of the country. If you leave the parking lot long enough, the balsam fir will come up through the paved road. We should know that since 1982, we have been trying to manage the balsam fir and we have just realized that it is managing us. Here is the proof. With all due respect to what you are trying to do, that is to convert balsam fir forest, this is a great leap of faith in forestry, if you think you can do that for the Northern half of New Brunswick. Thank you for letting me say what I want.

Louis LaPierre: I would like to let Dave make a comment. But first, I would like to highlight what our group said. We said that the management plan needs to respect the disturbance regime and identify that in certain parts of the province, the species was above pre-settlement. It may not be the case for the Northern part of the province, I do not know enough about the distribution, but maybe Dave Oxley can explain.

Dave Oxley: Mr. Chairman, I am like Max, I am old enough that I can say what I want to say. I will direct it to you, Max. Northern New Brunswick is full of balsam fir and I would say that maybe the Green River up in the Northwest corner, is the epicentre of balsam fir in New Brunswick. As you go East to the Upsalquitch, Nepisiguit and the Big South that you refer to, there is truly a lot of balsam fir. In 1958, K.-C.-Irving decided that he would like to plant some trees. He was ridiculed by the Dean of Forestry, at the time. A lot of forestry experts in the province said that Irving was crazy. They said that he was trying to grow trees up there, where that could not be done. Finally, Barney Fleiger, who I believe was the Dean of Forestry at the time, credited him with inventing the spruce ridge. My point is that if you look at that Irving property, which is sandwiched between the Upsalquitch River and the Green River, there is less balsam fir today than there would have been without that planting program. Other things have been done, on a smaller scale, to try to eliminate balsam fir. If we do not start sometime now, we will never accomplish anything. I, for one, believe that we could reduce the amount of balsam fir in the province with plantation programs, with thinning saws and with incentives to harvest balsam fir, rather than mowing it down with the red spruce. Maybe we could get people to go cut the balsam fir out of their mixed spruce-fir stands, and then get more spruce. So, I do not agree with you a bit Max. Thank you.

Louis LaPierre: That is what we are here for.

Unidentified: I do not think we need to worry at all about eradicating balsam fir. I am sure it would take a millennium. It would not take years, it would not take decades, and it would not take centuries. It is always going to be around. Clearly, there are some areas of the province that are balsam fir country. Balsam fir does really well in it.

But, my concern is that I do not think we can afford to protect the balsam fir that is out there. I really do not think we can. I estimated 120 million dollars and Dave said it is more like 200 or 300 million dollars. But, our AAC and our sustainable harvest levels for Licenses three and four for sure, are dependent on balsam fir. They include the implicit assumption that protection is going to be the same as it was in the past. The yield curves are build off FDS plots that grew up through the 1950's, the 1960's, and the 1970's. This is the kind of protection that we had in the past. If we are going to manage balsam fir, let's say how much protection we need to keep it on the yield that we are expecting for it. And, let's see if we can afford to do that in the future. If we cannot, let's reduce the yields now, rather than do it later. I think that we can do some things in some conditions. But if it is pure balsam fir, extremely dense, you do not have any option. I am not saying that it is eradicating. But, you do not have any option with the thinning saw or anything like that. If there is some partial species mix out there, maybe we should be starting to try to move some of it to something else. I think that if you went back several centuries, you would find that we have a lot more balsam fir now, than we had then. I am not saying that there were not any then. I am sure that Cape Breton Island, Green River and Big South had a lot of them. I do not think that by trying to put some incentives in place to move some of the areas away from balsam fir is the right thing to do. The mixed wood types that you see balsam fir coming up underneath, softwood, you can go in and clear cut, but you are going to have balsam fir next time. Putting some incentives in place to move some of that away is not going to eradicate the species.

Unidentified: I have a comment as well. I just wanted to give a cautionary note, that if we move too far away from balsam fir as a target species to protect, and if we are only left with B.t., I will caution you that B.t. is probably not going to be able to be effective at protecting spruce against budworm in epidemic conditions. Just be cautious.

Unidentified: I am not as old as Max or Dave, but I usually say what I want to. I am getting there. I have learned a lot over this conference. I got a lot of new information. Being a landowner and a harvester, I realize that nobody is going to stop the budworm and nobody is going to kill the budworm. We have got to learn to live with it.

I think harvesting practices are one of the major ways to do it. It is not the answer, because there is no the answer. We have to do a lot of things. I do think that if we remove the old growth balsam fir and the mature balsam fir as much as possible, and we keep a young growth of it, we are going to accomplish quite a lot. So, I would hope that is what we could recommend as we go into that direction.

Louis LaPierre: Are there any additional comments?

Pat McArthur: I guess the comment that I would like to emphasize on is that we have different tools and different strategies for lessening the balsam fir. But, there are a lot of areas, especially up in the North Shore and in Gaspé, where those strategies are not going to work as effective as in other places. We have to have strategies in place to protect the balsam fir. Because, there are big investments, and there are communities up there that depend on it. Thank you.

Unidentified: As a young puppy, I would just like to note one thing that I do not think was covered by the groups. That was that we need a review of our current protection infra-structure related to aircraft pilots. What is needed for the next control program?

Louis LaPierre: Thank you very much for your comment. We do have that issue in one of our initial notes. We will certainly make sure that it is included in the infra-structure. We could include it in ours, with no problem.

5.0 CLOSING REMARKS

Are there any additional comments? If there are no additional comments and no one wants to argue anymore, I would just like to say, on behalf of the Round Table, that we thank you very much for the effort that you have put into this. There is no question that the debate is going to move forward. I think there are some very good ideas that were brought forward here. For example, the structure that Dave Coon identified, that the debate should continue and many others have identified this.

Hopefully, this will be brought forward. I think what we need to do now is get a structure in place where that debate can take place and the issues that we have brought forth can be grounded in science and be grounded in facts, before they move on to be applied across the landscape. There are certainly going to be some areas in which we have to pay particular attention. I think overall, we are moving into the 21st Century. The practices of the 20th Century, even those of ten to fifteen years ago, will not be socially acceptable tomorrow. We need to see how we can best arrive at developing strategies. There may be a variety of strategies that will reflect the multiplicity of the landscapes. I think we need to move forward to try to develop these. And I think we have laid some groundwork here. Your comments will all move on to the Round Table for a further round of debate. The Round Table would hope to have its document finalized by September, and its comments to the Cabinet prior to December. What you have done here today will be brought forward to the Round Table.

How will it happen? We are going to take these papers and type them up. We have the benefits of the tapes from the presentations. So, there will be a report put together with all the presentations. Then, there will be a synthesis document that will be the result of the round table discussion this morning. This will go to the Round Table. There is a Forestry Subcommittee at the Round Table. First, they will get the information that was said here, and prepare it for the Round Table. As they do that, they will pull out some of the major themes. For example, the recommendations that have come from each one of these issues. They will list these recommendations, and then the document will be prepared for the Round Table. The Round Table takes it, debates it and decides what it will put forward to the Premier.

As you know, the Round Table has a broad spectrum of people from across New Brunswick. It is supposed to be a "cosmos" of society, and I think it has a pretty good mix of different views.

What comes out of it? I can not prejudge what the end result will be. But, the results of this meeting will go on to the Cabinet and the Premier. Then, there will be a presentation in the Fall on options that the Round Table suggested.

Unidentified: Are there any considerations of reporting back the results to this forum, as regards to how the information that was generated today is going to be incorporated into the Round Table report.

Louis LaPierre: I guess there is no problem in keeping this group informed. The Round Table has its members, then it strikes a committee. The committee that looks at forestry is composed of five members from the Round Table. They have the responsibility of looking at forestry associated problems. We have instructed a bigger committee of stakeholders and decided to work on the formats that we have. First, was holding a general workshop to see what the problems were. We could certainly come back and report the issue to this group. But, since the Round Table reports to the Premier, the Round Table documents can only be made available through the Premier's office. The Premier makes these available, if he so wishes. I do not think there would be any problem in sharing with you, what the Round Table is going to present today to the Premier. Is that what you had in mind?

Unidentified: Yes, I think we have had really good input here in the last couple of days. I think to keep the process viable, it is somewhat of a public participation process. I think that to give the credibility to the people who participated here, they should be aware of how the information was incorporated.

Louis LaPierre: There is no problem in doing that. The Round Table will issue an early report. That early report will have its recommendations and reports that it has worked on. This will be a published document of the Round Table. We intend to publish this as a second. As I indicated, we sent the first report to the printers yesterday. We hope to publish this one, and everybody here will get a copy of it. We will see that you get a copy of the recommendations from the Round Table. Whether you will agree with them or not, I do not know. You will have to see what the Round Table says. I cannot prejudge that. Hopefully, they will take all your good ideas and move them forward, because they are all good ideas.

Are there any additional comments? If not then, I thank you very much for having taken time from your busy schedule for attending this meeting. I would like to say a special thank you to Maureen and the people who have helped her pull this together. A conference like this just does not fall out the sky. There is always someone who has got to do the backroom work. If we do not get the paper on time, if we do not get this done on time, we all say where is it? The fact is that there are a lot of people that do work behind the scenes. So, I would really like to thank Roxanne and Bryana for the work that they have done, and anyone else who was associated with it. I know Maureen had other staff helpers. I would like to ask you to give them a round of applause. We have a Steering Committee from the Round Table that have helped us. In that Steering Committee, there are many members who do their jobs, but then there are people that go beyond doing their job. Again, I would like to thank Nelson Carter. Nelson is really the busy-bee behind the process. He keeps calling me and saying, Louis did you do this, and Louis I did this. I would really like to thank Nelson. He did a sterling performance again in getting at the people. He had to get on the phone and get people lined up. Without Nelson's contribution, we certainly could not have gotten this conference under way. Thank you very much for your support Nelson. Thank you very much and have a safe trip home, so long.

Unidentified: Thank you, Louis.

APPENDIX A

FORESTRY PROTECTION

DEVELOPING A STRATEGY FOR NEW BRUNSWICK

BUDWORM WORKSHOP

SUMMARY NOTES FROM THE FOUR BREAK-OUT GROUPS

MAY 5 - 6, 1998

FREDERICTON, NEW BRUNSWICK

SUMMARY NOTES FROM THE FOUR BREAK-OUT GROUPS

GROUP 1 : INFORMATION, EDUCATION AND PUBLIC INVOLVEMENT

Alistair Bath: For starters, our group was really energetic. We had a really enthusiastic group. We figured there would be some good discussions and maybe some controversies about some of the things we were talking about. So, we organized our ideas using sort of a European card system in terms of facilitating. The first shade is just a set of discussion rules. It will help you interpret what we actually did in the flow of discussion. We started with some discussion rules that would just help us to find this flow of discussion. Thirty seconds was the speaking allowance, because we did not want any monologues to occur during the discussion. We were going to write down all the ideas and we were going to express each idea on a card. We had one idea per card. We did not want to have just key words on the card. We had to have an idea expressed by that card. If somebody had an objection to that card, that was called a flash. Enthusiastically, we got into this. We were behind closed doors, so it was okay. But, Ed's group beside us, heard us. The flash is a red arrow, and that will give you an indication that there was some discussion about an idea that occurred. Then, if you follow that red arrow, you will see ovals. The ovals are the flashes or discussions of some of the key ideas. In our group, we also stressed that saying yes while really meaning no, just leads to more problems down the road. It is better to have that discussion and generate a little bit of controversy, than produce something that at the end of the day, we are not that sure about.

We started with information, education and public involvement. That was our initiative. The purpose for this workshop was to develop a coherent strategy to promote forest protection and control of spruce budworm. We just generated a couple of ideas of control budworm meant to protect.

The first issue is to promote forest protection. A couple of discussions from yesterday suggested that we really are protecting timber supplies. But then, we also captured some ideas from Dave's presentation that the non-timber values and protected areas are also important. The first question we started with was is this a priority issue? We found that it is a priority issue, because sometimes the media will be misrepresenting it, and this can happen really quickly in terms of the Internet. The public tends to fight our efforts. There is a lot of misinformation and inaccuracies out there. We need more informed and better decisions. There is a need for informed decisions. Then, there is some discussion that maybe not everyone has to be informed, and that education is a continuing process. The discussion revolved around the idea that just because you inform people, this does not mean you are going to change attitudes. Maybe you need to learn more about what kinds of pieces of information to give and the values around that. We have to look at all potential impacts like social impacts, economic impacts and ecological impacts. The public is getting more a right to know what this information is about. That is a reason why this is a priority. Better policy will result if we address information education and public involvement. The public will demand more unbiased information and involvement as a resulting idea. There is going to be a budworm outbreak at some point in time. So, we better start thinking now about the importance for future generations, and the need to avoid crisis management. We are trying to get a sense of why public information and education is important. If we understand why it is important, then we can start identifying what the problems and the issues are within these things. That is what the next three issues are addressing. This question of what are the problems or issues within each of these priorities?

The group came up with nine different problems. First, we recognized a problem of public participation in the government role. The government does not recognize that public input is as much important as industry input. They do not tend to involve the public. As you can see, that generated a few flashes and a few discussions that industry is listening through public participation. Then, that was generated and it was said that the industry could chose when to participate and who will participate. Under the goals and objectives of government, they give that responsibility to the industry. Maybe that is not quite fair. The government is changing though. Public participation is a reality. So, how do you include or use this information? How do you make this thing happen? These were all resulting discussions from this comment.

We labelled that public participation and the government's role. Another problem is about funding. There is a lack of research funds. The more you move further away from the problem, the more distant and the more tough it is to find research funds. Then there were some comments about the fact that you need to have the environmental groups there to support this basic research, and get them onside.

The third problem here is how should we send the message? Who is going to be the messenger? How do we select who presents information to these various publics? We need to have a credible presenter. Again, that generated a lot of discussion on the fact that it should be unbiased. Maybe it is not an individual, but it is a process. Perhaps we are looking at something like a policy advisory process or a group of individuals. Other things that were linked with this problem was, what is the appropriate form to inform and educate the public? Maybe we should get away from this wording of inform and educate. Maybe we need to learn to respect other opinions. That comes through to when we talk about the government. Again, in terms of respect, trust, and credibility. Changing opinions may not even be possible. Again, we are emphasizing the importance of respecting rather than just informing. We need to have some group in place as a constant group participation, so that you are addressing this. Currently, the lack of this, is what the problem is. The fourth problem is general awareness. There is a lack of public knowledge about all these various control methods and control options. There is also a lack of public knowledge about all these various control methods and control options. There is also a lack of public knowledge about what exactly spraying is. There is a real sensitivity to spraying issues in the forest. That is probably because of past personalities and credibility issues. That is all tied up with this awareness question. There are a range of options that need to be communicated. There is also the need for managers and decision makers to examine all management options. We do not just have to look at spraying, but we have to look at all kinds of different possibilities with the discussion. On the final page of what are the problems and issues, and this came out of Wendy's discussion yesterday, is a lack of understanding and confidence in the Federal Registration System. Being informed does not necessarily change the process. We label that as a confidence and a bureaucracy problem.

There is also a need to share success stories. There are actually some positive things that have happened. We need to learn from the past experiences and get them. At the moment, we have intended to do that. That is why it is a problem. We have to communicate that better. A lot of decisions are made on emotion or on lack of emotion. We labelled this set of ideas, emotion. There is an initial comment of the lack of provincial pride or interest or importance in forestry. Then, there is discussion that maybe there is some awareness, but politicians need to become more involved. There is discussion that maybe there is a lack of emotion in the public towards the forest. Then, there is considerable discussion that definitely emotion does exist. The group beside us, Ed's group, can probably attest that there was emotion in our room.

The final problem here, is on respect. The forest industry cannot force their views on their public, then generated discussion and say it is not just the forest industry. Everyone has different views that are trying to be forced on the public. We have to be more credible than that. The credibility issue comes up. It has to be sensitive to values and other kinds of issues related to sharing different view points and gaining trust. The forestry equals public dollars. Because, you are dealing with an issue that is publicly funded, there tends to be more reaction.

The group brain stormed on all of these different problems. Then, we labelled these problems and we grouped some of these cards together. We generated these ideas, we moved them all around, and we grouped them. Then, we prioritized them, and that is what these little red dots are. The issue that came out as the top priority or the issue that this group would like to send for discussion, is the one on awareness. How did this come out? The members of the group were asked to put dots on the issues, to prioritize them. The topic of awareness came out as the issue of highest priority. We have to look at awareness. The issue that came in second was to look at the how. How are you going to implement it? This received quite a lot of votes too. This group worked really hard, and it had me working really hard.

We made all the cards during the exercise. All the cards were made during the discussion. So, the group got a lot done. The final issue was our "how to" question. How are we actually going to do this? How do we do this?

We need some sort of interdisciplinary committee that will report to the Provincial Round Table. The role of this committee would be an advisory group that would start looking at the details, start flushing out these problems and getting to the specific messages. What kind of messages in terms of, what should be communicated? It was also felt that this committee should have some sort of research mandate, so they can actually collect data. The logical first step might be in terms of, what does the public already know? And what is the linkage between public knowledge and beliefs? Maureen made the comment that before you start educating, you have to know on what level you are starting at. So, you do not shoot too high or too low or on issues that do not seem to be important or linked to attitude. The group figured that the time frame for this group was in the next five years. But, there was also some good discussion about how we have to move faster than that. Perhaps we need to stop creating more and more committees, because we need to get going and produce some fast messages. That was flashed as well. We also need a coordinated approach. We cannot just randomly go out there and communicate the messages. We have to try to get everybody on our side. And, this is as far as the group got. We knew that we also have to think about who the public is, but that is something that this group might do at a later time.

Are there any questions or comments? Did I represent the group's views, accurately?

Louis LaPierre: Thank you very much Alistair.

GROUP 2 : BIOTECHNOLOGY AND NEW CONTROLS

Ed Hurley: The first thing is that we are trying to answer three basic questions, why, what, and how. Why, being what kind of a message should this group define in aiming at the Round Table group? This particular group was based on biotechnology and new controls. I cannot remember what the group title was. We did not necessarily get off track, but we dealt with technology, biotechnology, new trends and tools towards an IPM approach, etc. At this point, we need to define what that means, in terms of this overall issue. Basically, the aim here is to control and prevent an outbreak, minimize the impact of spruce budworm on the forest of New Brunswick and the surrounding jurisdictions. We definitely need more tools or a tool kit.

There should also be alternatives to traditional approaches. This is some of the language that is in here. I want to make a distinction between what we have now and what we will work towards. In our whole exercise, that was some of the initial thinking in this. What do we have now? Where should we be going? We need an application of tools. Our tool kit may consist of tools, techniques and methods. The idea is that the application of those tools within that kit is applied in parallel or in sequence. There is a strategy implied in that area. This concern in terms of control is what it imparts in the public's eye. Some of the flashes came up over here. Public perception and information is important. Social acceptance and sensitization to this whole problem of control and biocontrol are also important.

The message that the group would want brought to the board, is that this is for the next spruce budworm outbreak, at least on the shorter terms. Some of the things we might get into here, will definitely or maybe be on the longer term. But, the group felt that an immediate time frame was needed. We need to deal with the technology issue, now. There are also tools that are in need of testing and decision-making. There are a number of products sitting on the table. We have to get them past that point. Can they actually be used in the field? So, that is why the group felt that this issue needs to be dealt with in a very near time frame, at least to be addressed to the Round Table.

From that point on, we got into some of the limitations or problems that would arise in deciding what to do. The response is that we are dealing with some of those problems. We are also trying to do something towards dealing with the next spruce budworm outbreak in terms of biotech and that whole issue. The first thing that came upfront, and that was considered of the highest priority, was to establish a biocontrol network. A network is a model. I have put quotes on biocontrol network, because some of you will say that there is already one there. But, this particular network might be an organisation or a group. We got into a side discussion on whether this is a mandated organisation that might consist of investors, universities, scientists, etc. It is a model in terms of getting the right people together with the main objective to get new products to the market place. Some of the discussion centred on the fact that the current business climate is seen, by many, as a restriction to getting new products to the market place. So, how would you go about that?

With a mandate, this group might be an incorporated network who's energy would be primarily objective to get new products to the market, as registered products. Perhaps linked to this group would be a super expert group of scientists, probably chiefly scientists, to address all of the biotech tools, specifically whether you are talking about Mimic[®], whether you are talking about neem, whether you are talking about other biorationals, etc. There are core groups of super experts that could deal with these things and consider the opportunities that are there, and how they might advance them. We did not get into details of how they would be linked, and in what way. But, I think of two separate entities that would be working together. In terms of some of the actions identified for those two groups, they would basically have a meeting. Not for the sake of having a meeting, but at least to form this group, they would have a meeting of stakeholders. The stakeholders could include investors, venture capitalists, suppliers, scientists, governments and users, etc., in general terms, to get together to set targets for new products. The energy would be spent on meeting a primary objective for these groups of stakeholders. That would be to get new products out on a fast track, and to do whatever is needed to get it out. Meetings are always fun and wonderful, but are you actually going to get anything out of it.

The second item is to set targets, and that is of primary importance to this group. You have got to set the targets and push hard. Who is going to do the next Bioatlantic? You need someone to lead it. Bio Atlantech offered themselves the task of leading it and calling for that formative meeting, and then getting the show on the road. That is the first priority in terms of some organizational group without a lot of specifics. In general terms, the first action is to get together and to get the show in the road. The next priority, not of lesser priority, is the control products themselves. We had a long list of control products. We certainly heard those yesterday. Some of those products are registered, but perhaps not enough of them. The idea here is in terms of dealing with this issue of control products. The action is to evaluate, and this will be obvious. But, we need to evaluate the potential of the product and continue the work on these products. I have listed several of the products that we heard yesterday for registration. These products need to be registered, so let's do it. We also need to continue to look for natural biocontrol agents. Do not let that little wheel stop, you have to keep looking.

Some additional details might be, who is going to do it? What organisations will be involved? How are you going to go about it? I did not want to get into that layer. I just wanted to identify this as a very important component or action in terms of control products. We have to keep looking for the magic bullet. We cannot stop.

That was the message. Just to remind all of us that the idea here is a contribution to an overall IPM program. So, these control products are not the only thing. But, they are part of a larger IPM project or strategy. In this exercise, I listed, as one of our option, to put together an organization that would deal with control products and the actions for that. And then, we get two application technologies. These things are all very intimately linked together. If that is not obvious to you now, it will be in a moment. That fell out maybe more by chance than design, but it seems to work well in principle, here. So, you deal with your control products.

Application technology was another major concern that should be dealt with and how you might action it. Again, this is very general. But, it is a parallel exercise to product development. You can not just say, here is a neat little product, and then, get it out there in the forest. That would work in parallel with the control products and any products for registration that can be identified by that team of experts to get it to the market. So, you see how these link. The primary action under application technology is to review the current application technology for registered products. There was some discussion about some confusing information or results about application of B.t. I think it had to do with potency and volume rates etc., how does it work? There is conflicting information there. So, we have to resolve it somehow or review it. This is a big task, but it is one that needs to be done. The objective is to optimize it.

Finally, last but not least, is to look at tree improvement and this overall picture again. Some discussion about tree improvement programs in the past and perhaps more recently, tend to look at tree improvement from the perspective of yield and growth productivity. To make sure that those attributes are looked at, is to make sure that any opportunities for pest resistance are picked up on. Sometimes that is implicit in tree improvement, but is it actually being done. There was some discussion on that.

It was certainly considered and it may have been recognized in the past, but is it done enough as a strategy? The action might be basically to back off a little bit.

Yesterday, there was some discussion in the presentation about genomics. That we need a team for it that might start addressing some of these things. There is only a single action item, and it is the only one that needs money. That is a joke. I think that would rap up this team's summary analysis. I invite anyone in our group to add to my presentation. If I have done any disservice to this in recording the discussion, please help me out here or help the group. Are there any questions?

Louis LaPierre: You seem to have captured it all. Dean Toole, you are next.

GROUP 3 : MONITORING AND POPULATION TRENDS

Dean Toole: Our group looked at the monitoring and population trends. We started our discussions with talking about the "why". Why is this an issue? Then, we brainstormed some the problems and the issues related to that. We went through a fairly extensive process on that. We ended up synthesizing them down into one general recommendation, and four main recommendations that we would like to come forward from this group to the government of the province. We synthesized them very specifically into these five topics. So, if you do not remember anything else, these are the issues that we want you to take forward. Then we have a number of background issues that come out of them. So, I will go through those. The general recommendation leading to all of this is that we need to make a commitment to an Integrated Pest Management Strategy. That is what we have all been talking about. Obviously, our group ties very closely to the other three groups. As a follow up to that, we suggest that the issue be tied to the National Integrated Pest Management Strategy.

There are four different commitments that I have double slashed here. The first commitment is government commitment to the development, implementation and funding of a comprehensive sampling program, that reliably monitors population levels and trends. That is a statement we want to take forward. Under that, some of the things we have discussed is that we need to have a method of standardization. There is an entomologist side of the meeting of October, in Toronto.

I believe Ed said that we felt that we should be part of that meeting or that we should have a lead in it. There is also a Pest Management Forum, and there exist a Forest Protection Technology Committee. These were the organizations that we should have been put into to make sure that there is a standardization of methodologies for sampling and to make sure there is a commitment. Brackets commitment, in our definition, means funding from the Department of Natural Resources and the landowners towards ensuring that this strategy is implemented or developed. We also should make sure that there is a commonality with sampling methods to ensure that the results can be comparable. That is within province and across jurisdictions. There also has to be a commonality in the reporting strategy. The other big issue is to ensure cooperation, coordination and compatibility with neighbours. We are talking about other agencies both provincially, nationally, and internationally. It was felt that the component of this should be institutionalized, and that someone should take the lead on this. As an example, we would suggest that the CFS Forest Health Network may coordinate this effort nationally and internationally to roll up this information and to make sure that we have a common effort in this run.

Our second recommendation is government commitment to the development and implementation of a strategy to protect forest resource values from spruce budworm. We are talking about all forest resource values. Components of that is an early intervention strategy. Other things we have discussed is population suppression in selected areas that are part of that strategy. Another important point to consider is the understanding regarding the socio-economic impact of the spruce budworm on all forest values. Basically, we are talking about a risk benefit analysis. When the time comes, we have to make a decision of whether it is an early intervention process strategy. Then, we want to have the tools to make the risk benefit analysis, so we can make an informed decision as to where we go. There was one recommendation that we felt was fairly immediate and that it would probably go to the Premier's Round Table as opposed to the Cabinet. This recommendation was to host a workshop in similar format to what we have done in the last two days. This would be done to increase public awareness and to develop a strategy for early intervention. It was felt that we should do that with all the stakeholders, and with as many people as we could get to attend from all interest groups. This workshop would be on a two day format. Similar to what we just undertook, it would include presentations in the first day to set the stage.

Then, the second day would suggest that we would look at the decision support models that Dave MacLean has put forward and developed for the province. You have seen the maps up there on the wall during his presentation. Through that exercise, we could work with the different stakeholders and show them potential impacts of an impending outbreak. We could also take that down to the woodlot owner level or to the particular land owned base level. So, people will actually see the impacts of the spruce budworm on as many forest values as we could do for that exercise. We would also be talking about forecasting those impacts.

The third recommendation is a government commitment to the development and implementation of a public education and public input program, regarding spruce budworm and its potential impacts. We are getting back to the potential impacts again. We want the public and the landowners to be informed. Then, they will be able to make an informed decision when it comes to making a decision as to protection and as to the level of protection. We suggest that things like education, public participation and raising of public awareness should be carried out by an unbiased third party. Some ideas from the first presentation, suggested that possibilities for that role would be the universities, Fundy Model Forest, and the woodlot owners associations. Those came up as possible examples of people that could carry that message forward.

The final recommendation was government commitment the development, implementation and funding of a research program in support of improving our Integrated Pest Management Strategy. So, those are the four major recommendations of our group.

Does anyone from the group like to add to that? We wanted to put forward recommendations that would be taken to the Premier's Round Table, and then to the Premier and Cabinet. Are there any questions? Thank you.

GROUP 4 : FOREST STRUCTURE AND MANAGEMENT

Louis LaPierre: Our group was the forest structure and management group. We started our discussions on why should we move towards a forest management structure?

The discussions focused on numerous issues. But, one was to reduce the susceptibility of the forest budworm infestation. The objective on this would be to reduce the balsam fir component in the forest. We decided on that, accepting the fact that our forestry practices up until now had favoured the balsam fir, since it was an agent in supporting the budworm. We have to move forward in trying to suppress our effects of management practices that have changed the forest structure. We have also managed forest insect populations over time. So, all of this has given us a different forest. We also agreed, from the discussions, that moving towards a managed forest structure would be more acceptable to society than spraying the forest. We also identified that it was certainly more in tune with sustainable forest management and that it could be integrated into adaptive management strategies. At the end, it should allow us to have a higher value for our forest. We continue with numerous other reasons as to why. But, we certainly had a consensus that it was an objective towards which we should move. And we should move quickly towards it, because there are activities that we could start right away.

We started with the preamble and we arrived at three basic components of our strategy. The first component is that if there is more balsam fir in the forest today than in pre-settlement conditions, whatever management plan is put in place needs to respect the natural disturbance regime. We looked at activities that could be undertaken. The first part of our recommendations was that we should look at operational activities that would tend to reduce outbreak severity. Most of these operational activities could be short termed and started right away. For example harvesting strategies, with the objective to reduce balsam fir, could be integrated very quickly into management plan. Following this activity, you could include a silviculture. The safe concept could be silviculture thinning and planting activities. Then, the management-planning objective would be to reduce the balsam fir across the landscape level.

The planting of trees supports the objective of reducing balsam fir. These are all short-term operational activities. Some of them have long-term implications, but they could all be started today. These were all things that we could do.

We have also identified, as other groups have, that we need to have a policy structure to support these objectives. There is a need in New Brunswick, because of the overall dependence and contribution of the forest to our economy. The province of New Brunswick, more than any other province in Canada, should have a policy statement. A policy statement which would place its new forest management strategy for the 21st Century. In this policy, we would incorporate the intrinsic values of the forest, which means that there are other economic values. The forest certainly has an economic importance and that should be stressed. A strategic direction and a vision statement should be put in place in this policy. The research and funding agenda should be identified. We should clearly define the protection policy for both timber and non-timber value, so that we have a framework from which we can work from. We have the importance of this policy. This policy could then be forwarded to some central government agencies. For example, there is a priority in place for New Brunswick. For once, New Brunswick has a priority which is the development and maintenance of its forest within a strong economic development for the 21st Century. We have also identified that in order for this to work, there needed to be an advisory working group to DNRE. This group should be multi-stakeholder and I think a few groups have already identified this.

There is an importance to feed on a continuous basis that the opportunity for dialogue needs to be developed. You need to have an opportunity to share your views and an opportunity to debate them within structure, within science, and to see that they will support it. There is an opportunity for the public to support integrated pest management options. The group thought that there was a need for incentives to accelerate. For example, as short-term, we could put in place true policy incentives to accelerate the harvesting of balsam fir and promote more abundant species. We did not identify what we meant by abundant species, but we can look at pine spruce, red spruce, etc., and the structure of trees that were there in the past. To do this, we had some specifics, so we could reduce stoppage on balsam fir for a fixed time period in which to allow that conversion to take place. We could encourage the plantation of red spruce, white spruce, and white pine regeneration through shelter woods. We could build a balsam fir management option as a requirement in the next plant cycle with the objective of reducing balsam fir across the landscape. The incentive should not be given, unless one agrees to include C in the process.

You get no incentives to cut the balsam fir on stoppage reduction, if you did not agree to include a long-term management of balsam fir across your land. We need to use pre-commercial thinning to support the policy of reducing balsam fir. So, we looked at some of these issues.

A third component was research. Within the context, spruce budworm biology and impacts about attractants are very important. We wanted to test at attractant specific stand and forest level variations on spruce budworm populations and the impacts on trees. That would take it from low populations to have a look at the overall structure, how structure defines the population? And then from that, the objectives would be to identify and define pest management plans at the stand level. We would need to define and plan activities at the landscape level. The opportunity to do that was now while the populations were low, so we could move forward. We can also look at some indications of tree genetics, biological control, parasitoids, and the importance of structuring partnerships or liberage of funding, particularly at the granting agencies.

We have also identified an issue that was outside our mandate, but of importance. We did not have this to consider. But, we need to structure a process to bring to society the message of integrated forest management, the new forestry for the 21st Century. Within that strategy, we must focus on ensuring that the public understands what integrated pest management is, what the new forest structure is, what are the research options, and what are the consequences of budworm outbreak and of other insects within the forest management structure. We also want to relate these consequences to the social benefits or the social problems associated with economic and ecological problems.